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Editor: C. W. Winders, B.Sc.Agr.

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Safflower Growing on the Darling Downs

By L. E. BRANDS, Adviser in Agriculture, Toowoomba.

Safflower can be grown satisfactorily on the Downs, but extensive planting cannot be recommended until a stable market is available.

Safflower (*Carthamus tinctorius* L.) is a somewhat prickly annual belonging to the saffron thistle family. Its origin is believed to have been in the region extending from India across Arabia to Egypt and Ethiopia.

This is a crop of great antiquity and it was grown formerly as a source of red dye for silk and cotton. The dye was derived from the flowers. The plant is now cultivated, however, for the oil produced in the seeds. Safflower oil is used for soap, paints and varnishes, as an edible oil, and as a lighting fuel. The cake obtained after extraction of the oil is a useful stock food.

Climate and Soil.

Safflower is a branched annual growing 1-3 ft. high, and there are spiny and spineless varieties. The plant is generally upright in habit and develops a strong taproot. The stems are pale and the leaves medium to broad, with or without toothed margins. Flower colour ranges from white, to orange, to yellow. The flowers are usually borne singly on stems. The seedheads taper upwards and are surrounded at the base by a few small leaves.

Safflower is suited to a wide range of soil types varying in texture from light loams to heavy clay soils. A

Plate 1.

A Typical Safflower Plant, Showing How the Seed Pods are Borne Singly on the Stems.

good moisture supply in the early stages of growth is essential; thus a long fallow will provide the best seedbed. Excessive moisture following sowing or even during the seedling stage affects safflower severely if the soil is not well drained.

Due to its deep root system, safflower is a fairly drought-resistant crop. Crops respond quickly to spring and early summer rains, although heavy rains during flowering can affect pollination, and so reduce the yield. This is not a new problem to many Queensland farmers. Those who grow cotton and tobacco, for instance, try to adjust planting dates in order to avoid maturity during the wet season.

Though best sown in late winter, safflower may be injured by frosts during the early stages of growth. The variety most widely used in Queensland—Horowitz—is, however, somewhat frost tolerant and has given good yields despite apparent frost injury in the seedling stage.

Seedbed Preparation.

Although safflower grows under comparatively dry conditions, a moist seedbed is required for satisfactory germination and early establishment. A long fallow therefore is necessary, with subsequent cultivations aimed at destroying all volunteer growth and providing a good surface tilth for the seedbed.

A clean seedbed is more necessary for safflower than for most other crops, as the plants are very sensitive to hormone weedicides and so cannot be weeded easily by spraying. When the weather becomes warm, however, safflower will overtake summer weeds under good growing conditions, and shooting above them will eventually smother them because of its branching habit.

Plate 2.

A Safflower Crop in the Pittsworth District. The crop is 3 months old and about 30 in. high.

Seed for Planting.

The use of good seed cannot be too strongly emphasised. As certified seed is as yet unprocurable, clean, uniform

and high germinating seed should be saved from a crop harvested locally or bought from a reliable source.

It is strongly recommended that all seed be treated with one of the proprietary seed fungicides prior to sowing to prevent pre-emergence rots and thus ensure an even stand. A thorough dusting at the recommended rate will give adequate protection.

When planting, the seed should be placed in contact with good moisture at a depth of approximately 2-3 in. The sowing rate varies from 20-25 lb. per acre, with rows spaced 7 in. apart.

Safflower crops usually require from five to six months from sowing to maturity. The most suitable sowing time is July to early August. Sowings before this date often result in tall crops which may prove troublesome at harvest.

Varieties.

A number of varieties are under investigation in Australia. They differ in colour of flower, degree of spininess, size of head and oil content. Only one type (recently named Horowitz) is at present available for planting in Queensland.

Spineless varieties have been developed and these are claimed to possess good grazing possibilities in the earlier stages of growth. No practical information on this matter, however, has been gathered so far on the Downs.

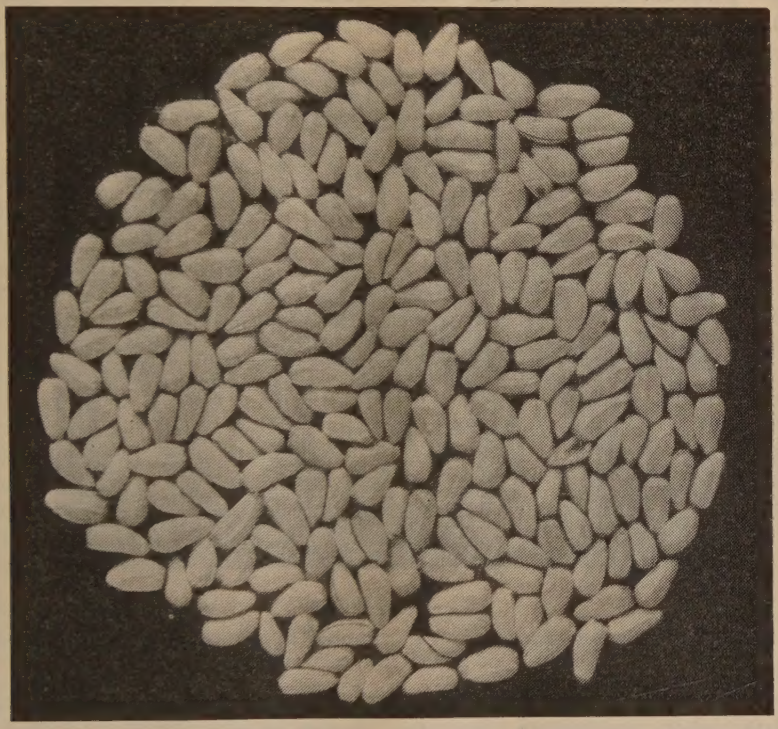


Plate 3.

Seed of the Standard Variety, Horowitz.

Harvesting and Yields.

Safflower can be easily taken off by any header. Usually lifting the drum and slowing down its speed is all that is necessary. If the stalks are very coarse, one or more fingers should be removed from the comb. So far, no reports of harvesting difficulties have been received.

Yields of half a ton to the acre are quite common, but yields of up to a ton to the acre have also been recorded.

Pests and Diseases.

So far, no serious diseases have been experienced in safflower. As a precaution, proper seed dusting to control likely seed and seedling rots is emphasised.

Aphids have caused some losses. As damage caused by these insects is more pronounced on weak and unthrifty plants, the importance of a clean, well-fallowed seedbed to obviate weed competition can be appreciated.

Information regarding pests and diseases in safflower can be obtained from officers of the Entomology and Plant Pathology Sections of this Department.

Marketing.

Safflower is a comparatively new crop on the Downs. Economic instability has been the main drawback to its development. Some time ago, however, a price of £45 per ton f.o.r. Sydney was offered. On this price basis, a comparison with linseed can be made. This indicates that a 30-33 bus. per acre safflower crop (which is slightly over half a ton per acre) will give approximately the same return as a 12 bus. per acre linseed crop.

The margin in favour of safflower will be further improved if the seed is dehulled before marketing. As 25 per cent. of the seed weight is represented by the husk, its removal would greatly reduce the cost of freight to the processing works.

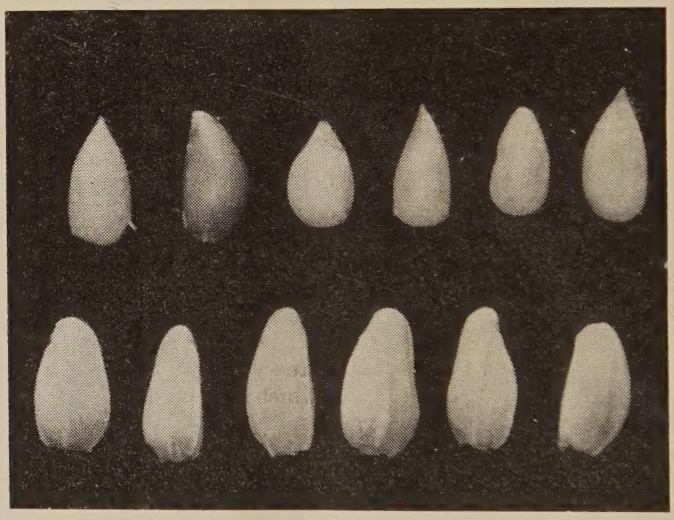


Plate 4.

Seed of the Variety Horowitz. The top row shows seed which has been dehulled; the bottom row, seed as harvested.

As dehulling does not reduce the oil content of the seed, the dehulled seed would command a higher price.

Safflower-oil when used in paints compares favourably with linseed oil because of its non-yellowing nature. Soybean oil possesses similar qualities, but is much more expensive.

At the time of writing, Japan is one of the strongest buyers of safflower oil from India. An opening on this market could mean an incentive to increased local production. The current market, however, is still not very stable and growers are therefore advised to keep their production limited to a known demand.

Growing Crops for Silage

By Officers of the Agriculture Branch.

Silage is made most easily from crops with a high content of of sugar and starches. Fortunately, both maize and sweet sorghum possess the desired sugar content and in addition produce a large quantity of green material.

SOIL PREPARATION.

The economics of fodder conservation are closely related to crop yields per acre; hence good crop husbandry is essential.

The greatest possible care in the preparation of seedbeds for the storing of adequate moisture in the soil before planting is necessary for successful cropping.

The land intended for the crop should be broken up well ahead of planting time, and left in a rough condition to trap as much rain as possible before weed growth makes subsequent cultivation necessary. In areas of low annual rainfall, where a 2-year period of moisture trapping may be necessary to ensure good yields, the need of early cultivation after ploughing can be avoided to some degree by using sheep to control weed or grass growth following breaking up.

This process of early ploughing, followed by later cultivations as required to control weed growth, is called fallowing.

As well as aiding the storage of soil moisture, fallowing provides conditions suitable for soil nitrification. Supplies of available nitrate are built up during this period by soil organisms which break down soil organic matter in the process. Adequate soil nitrate enables higher yields of better quality fodder to be produced provided sufficient soil moisture is present.

As a cloddy surface gives better rain absorption and better protection from erosion, the use of tined implements for cultivation is desirable. By planting time, however, both disc and tine cultivators, harrows and combine will have been used for preparing the seedbed.

The employment of contour farming principles whenever possible pays dividends in better crops, cheaper working and saved soil. In areas to be newly broken up for fodder crop production, careful planning should be done to avoid cultivating over drainage lines to develop an effective contour farming system.

Continual cultivation will exhaust the soil organic matter and cause deterioration of soil structure. This will reduce its water intake and water storage capacity. A farming system which provides for the regular return of cultivated land to a period under sown pasture is a recognised method of maintaining soil productivity.

MAIZE.

Maize is the most popular and also the most suitable of all crops for silage purposes in the higher rainfall areas. To promote good cob growth, it should be sown in rows just sufficiently wide to permit of inter-row cultivation. It may also be spaced more closely within the rows than when the crop is grown for grain.

The crop should be cut at the "milky" grain stage, when the grain is well formed but before it has commenced to harden. In practice the crop is more commonly cut when the grain reaches the late dough stage, when the grain has dented. A greater yield is thus obtained but nutritional quality of the silage is not so high.

The feeding quality of maize silage can be improved by interplanting a suitable legume such as cowpea with the maize. A difficulty here is to have both maturing together at a suitable stage for cutting.

Varieties of maize that have a high grain yield make the best silage and so hybrid maize suited to the district should be grown. On good soils and under favourable seasonal conditions, yields of 12-15 tons of green material to the acre may be expected.

SWEET SORGHUMS.

Sweet sorghums are next in favour for silage making. They are suitable for districts in which the rainfall is light or unreliable because of better drought resistance than maize and relative freedom from leaf diseases. They can also be grown successfully on poorer soil types than are suitable for maize. Sweet sorghums are recommended in preference to grain sorghums, which have more pithy stalks and a lower sugar content and return lower yields per acre of green material.

Sweet sorghum varieties may be sown by drill or broadcast. For silage purposes sweet sorghum may be sown in drills spaced either to permit of inter-row cultivation or sufficiently close to enable the plants to suppress weed growth. A satisfactory row spacing is 14 in.

When maize or sorghum is to be cut with a forage harvester with a cutter bar front or is to be mown and buck-raked into a trench silo, it is better to aim for a slender-stemmed plant. These slender stems cut better, feed better into the chopper, pack more tightly, exclude more air and so make better silage. The shorter, thin-stemmed crop is generally handled more easily by the forage harvester than taller crops.

Plate 1.

Row-crop Forage Harvester and Truck Harvesting Maize on the South Coast.

These finer plants are obtained by increasing the seeding rate, taking into account of course the amount of soil moisture available at planting time. The crop should be cut when the grain is in the soft dough stage.

The most widely grown variety of sweet sorghum is Saccaline, a tall, late-maturing variety, which has proved itself capable of heavy fodder yields over a wide range of conditions in Queensland. Other suitable varieties are Italian, Sumac, Sugar-drip, White African, Atlas and Honey.

Plate 2.

A Good Crop of Italian Sweet Sorghum.

SUDAN GRASS.

Sudan grass makes excellent silage and is a crop which is particularly suitable for inland districts because of its relatively good drought resistance.

The correct stage for cutting is when the grain is just forming. Given favourable weather conditions, two or more cuttings of Sudan grass may be expected in one season. From a well-grown crop a first cut of 8 to 10 tons of green material to the acre may be produced. Any subsequent cutting is usually much lighter.

Owing to the risk of impure samples of Sudan grass being contaminated with the seed of Johnson grass, only good seed should be sown. Certified seed is recommended. Sweet Sudan is the variety for which certified seed is available in Queensland.

Sweet Sudan grass was originally developed in Texas, U.S.A., and the material received in Queensland from that source has been subjected to pedigree selection for a number of years. Several pure strains low in prussic acid have been obtained, and one of these strains, S.S.6, has been placed in commercial production. This strain is shorter and leafier than other Sudan grass strains and stools

Plate 3.

Forage Harvester with Cutter Bar Front Cutting Regrowth Sudan Grass and Blowing it into the Truck Driving Alongside.

freely. The stems are juicy and sweet, and the leaves are broader and more resistant to leaf diseases.

WHITE PANICUM—JAPANESE MILLET.

White panicum and Japanese millet, which are fairly extensively grown for hay and grazing, are also of considerable value for silage, either alone or mixed with maize or sorghum. They can be grown successfully on a fairly large range of soils but are not so well suited to inland districts.

They are sown and cut in the same way as Sudan grass, but the yields of green fodder are somewhat lighter—6-8 tons per acre. Cutting should be carried out before the grain has matured. They are free seeders and shed their seed readily; they should, therefore, not be allowed to produce mature seed, otherwise a considerable amount of volunteer growth will appear the following season.

COWCANE AND ELEPHANT GRASS.

Summer-growing crops such as cowcane and elephant grass produce a great bulk of fodder and may be successfully used for silage if cut before the stalks become too woody. Up to 70 tons of green material per acre has been harvested from well-grown crops of cowcane.

PASTURES.

Pasture grasses, such as paspalum and Rhodes grass and others of an erect habit of growth, may also be used for silage. They should be cut after the seedheads have shown but before pollen has shed. If cut too young, an inferior silage is produced, unless controlled wilting is carried out or a preservative is used as discussed earlier.

Thousands of tons of useful green material in the form of native and sown pastures are wasted in Queensland in a good season. With modern harvesting machinery and storing in trench silos, a large bulk of this material could be ensiled and held until required.

LEGUMES.

Legumes such as lucerne and cowpeas may be used for silage. They can also be mixed with non-leguminous crops, thereby increasing the feeding value.

Lucerne is easily cut and handled and makes high-quality silage if modern methods are carefully used.

Cowpeas are much more difficult to cut and handle owing to their viny habit of growth. Consequently, they are not used to the extent they might otherwise be.

Some success has been achieved when cowpeas and maize or sorghum have been grown together or in strips side by side. These combination crops are more easily handled by mower and buckrake, or by the forage harvester, than by the reaper binder. Where planted in blocks side by side, it is practicable with careful planning to alternate layers of legume with maize or sorghum in the silo.

WINTER CROPS.

Winter-growing crops which may be used for silage are wheat, barley, oats, tares and field pea. The wheat varieties best suited for this purpose are Lawrence, Celebration and Charter. Varieties of rust-resistant oats, such as Bovah, also give good results. Generally, yields of green material from winter crops are not as high as those from summer crops, such as maize and sorghum.

Plate 4.

A Silage Team of Buckrake and Mid-mounted Mower Harvesting a Heavy Stand of Kikuyu Grass at Maleny.

STAGE OF CUTTING.

Crops need to be cut when the digestible protein content is at its maximum level and when the total yield of digestible feed is also high. With hay and grazing crops, this stage generally corresponds with that recommended for early-cut hay.

Sorghums are generally cut at the soft dough stage, maize when the grain has dented, and Sudan grass in the milky seed stage.

Lucerne should be cut at an early bloom stage; cowpeas when the first pods have filled.

Cereals such as wheat, oats and barley may be cut at any time from the shot blade to the soft dough stage. The earlier the cutting the lower the yield, but the higher the quality of the silage produced.

Grasses should be cut after the seedheads have shown, but before pollen has shed.

It is emphasised again that the moisture content of the crop at the time of ensiling is most important. Dry or flush seasons could make it desirable to harvest the crop at an earlier or later stage than that mentioned.

SILAGE QUALITY.

The feeding value of silage cannot be any better than the crop from which it is made, as its food value is directly related to the material ensiled. The quality of silage as a stock feed is measured in terms of protein quantity. This quality is determined by the crop and its stage of growth at the time of ensiling.

Silage of high feeding value can be made only from high-protein crops, such as young grass and lucerne and other legumes in the pre-bloom stage. A mixture of winter cereal and legume will produce a high-quality silage if cut at an early growth stage. In addition to cutting at the right time, correct handling of the material is essential if top-quality silage is to result.

High-protein crops have high moisture content and are low in sugar and starch. Wilting or the addition of ground grain or a preservative, such as molasses or sodium metabisulphite, is essential.

When well preserved, this material has a golden yellow to light yellow-brown colour and a clean acid smell.

As grass reaches the flowering stage, the protein level falls and only a medium-quality silage can be made. Likewise, only medium-quality silage can be made from legumes in full flower or winter cereals in the milky stage.

Lower quality silage is produced from crops such as seeded grass, stemmy legumes and high-sugar crops such as maize, sorghum and Sudan grass cut at the soft dough stage. Silage made from these types of crops will require supplementing with some protein concentrate such as linseed meal, peanut meal or meatmeal to provide a maintenance ration.

In practice, the high yields of fodder possible per acre make maize, sweet sorghum and Sudan grass very popular crops for silage despite their low protein content.

FAUNA NOT OVERLOOKED AT MARY KATHLEEN.

As a first step in ensuring the protection of fauna in the fast developing Mary Kathleen district, the Government has appointed an honorary fauna protector in the area.

The Minister for Agriculture and Stock (Hon. O. O. Madsen, M.L.A.) said that human activity, such as opening up new country, is the greatest factor affecting fauna populations. For this reason, his Department endeavours to provide adequate fauna conservation measures in newly developing areas.

Replanting Citrus Land

By S. J. KUSKIE, Adviser in Horticulture.

What trees should be replaced and how replanting should be done are the questions answered in this article.

Most commercial citrus orchards contain blocks of trees which are not fully productive and are therefore due for replacement in the near future. The need for replanting may be due to one or more of several causes: the trees may not be productive and some may have died following attacks by pests and diseases.

At Gayndah, Howard-Burrum, and Maroochy, the three principal citrus districts in Queensland, new land is not readily available for the crop. Although an orchard may be established elsewhere on suitable ground, the expenditure involved in purchasing the land, establishing the trees and maintaining them until they come into bearing is considerable.

Plate 1.

Young Citrus Orchard With Overhead Sprays. The productive life of the trees depends on orchard management; irrigation facilities are essential in some districts.

Growers therefore generally prefer to replant existing orchards rather than venture into districts with which they are not familiar.

Unprofitable Trees.

Citrus trees may be unprofitable simply because of old age. Under average orchard conditions, production per tree will, in the absence of injury from pests and diseases, increase steadily until it reaches a peak about 20 years after planting. From then on, yields usually decline.

Older trees also tend to grow so large that costs of spraying and harvesting become excessive and out of all proportion to the returns which they give to the grower.

In all orchards, the proportion of unproductive trees in any block increases with age. Many of them show acute symptoms of pest and disease attacks either on the framework of the tree or on its roots.

Root failure is particularly common on the heavier soil types where drainage is poor. Under such conditions, breakdown of the bark on the trunk and main roots, and odd dead trees, are characteristic.

Virus diseases are frequently responsible for decline in productivity. Psorosis is particularly common; the bark flakes away from the trunk and limbs with or without gum exudation and the tree loses vigour. Quick decline virus in mandarins and stem pitting in grapefruit also take their toll in the orchard. Some of these losses can be traced back to the use of infected budwood in trees propagated 20–30 years ago.

Plate 2.

Skeletonised Washington Navel Orange. Old trees with a sound root system may be rejuvenated by skeletonisation. Too often, however, old trees relapse again. Where there are many such trees, replanting the block is necessary.

Tree replacement may be necessary even when the trees are disease-free. The varietal position in citrus, as in other crops, is always changing. Types which were popular years ago may be virtually unsaleable now or command only low prices in a well supplied market. Replacement of obsolete varieties by types which are in current demand is therefore an integral part of efficient orchard management.

Tree failure is occasionally an after-effect of deterioration in the orchard soil. Such deterioration may be the result of bad drainage over a long period and the failure of the grower to get rid of excess water in the soil. Wet spots may develop after planting if a hardpan is formed by regular cultivation at the same depth. The structure of the land may also be impaired by loss of topsoil in orchards on sloping ground where no action has been taken to control runoff water during periods of heavy rain.

Before replanting is attempted, therefore, the grower should critically check the performance of old trees in order that faults in the original orchard layout or methods of soil management will not be repeated.

Replanting Methods.

Where part of the orchard is to be replanted, the unwanted trees are removed by tree-pullers, tractors or bulldozers. The work should be done thoroughly. Old roots should not be left in the ground; if they are diseased, they may simply serve as focal points for infection of the young trees after they are planted.

Plate 3.

Washington Navel Orange, Showing Copper Deficiency Symptoms. In addition to nitrogen, phosphorus and potassium, trace elements such as copper and zinc must be supplied to trees on replant land.

Ripping or subsoiling follows the removal of the trees in order to break up any actual or incipient hardpan which may exist. This work is carried out at least nine months before the scheduled time of planting.

Plate 4.

Young Citrus Tree Lifted in Nursery Prior to Consignment. Well-grown trees on orange stock are best suited to most replant orchards.

A new orchard is a long-term business enterprise which deserves a considered plan of operations. Soil conservation measures have a place in any such plan, at least on sloping ground where contour planting with its diversion banks and waterways is needed to handle surface runoff during the wet season.

The need for soil conservation measures is particularly important in areas where the profile shows only a limited amount of surface soil and subsoil clay is present at shallow depths. Such land is marginal for citrus, and orchards established on it can only be productive if the soil is efficiently handled.

Replant trees are sometimes less vigorous and less productive than trees grown on adjacent virgin ground. The causes vary from place to place, but decline in soil fertility as a result of previous cropping is commonly associated with the phenomenon. If replant trees make poor growth when they are young, the chances of their being "money-spinners" later on are remote.

There is therefore some justification for the traditional practice of "re-soiling" when odd trees are replaced in an established orchard. The soil used for this purpose is, of course, brought from uncultivated land in the vicinity of the orchard.

It is safe to assume that in fertility and structure replant land is less satisfactory than virgin land adjacent to the orchard. Young trees established in virgin ground are therefore better able to fend for themselves than trees established on replant land.

It follows that planting should be correctly done, that water should be applied, not when the trees wilt but when they require it, and that fertilizer and trace elements such as zinc and copper should be used in sufficient quantity to ensure a normal growth increment each year. There is more than a grain of truth in the statement that "the replant problem is primarily a problem of neglect" to justify emphasis on good cultural treatment of young trees as a major requisite in replant orchards.

Varieties.

The selection of the right varieties is fundamental to successful replanting. The greater part of a replant orchard should comprise varieties for which there is a payable outlet on existing markets and which are known to thrive

in the district. An orchard with a multiplicity of varieties is quite unworkable and a poor business proposition.

Once varieties have been nominated, the grower has to determine the type of rootstock required and locate a well-managed nursery to produce his trees.

For most varieties of orange and mandarin, sweet orange stock will unquestionably be the first choice, as it confers on the scion variety long tree life, high fruit quality and the ability to bear heavy crops. Other stocks such as citronelle and trifoliata should be reserved for special purposes.

When ordering citrus trees for a replant orchard, the desired stock should be specified. To ensure delivery on time, the order should be placed with the nurseryman at least 12 months ahead of the proposed time of planting.

This necessitates forward planning but, after all, the replant orchard has to be a planned job if it is to be a success.

FINANCIAL SIDE OF SOIL CONSERVATION.

In this day and age, most people will agree that soil conservation is a national necessity, whatever the cost. But to the farmer who foots the bill, the national interest takes second place. Whether or not he will apply soil conservation measures depends largely on economics.

Mr. J. E. Ladewig, Chief Soil Conservationist, Department of Agriculture and Stock, says there's little doubt that soil conservation is an economic proposition. These measures immediately arrest the worst erosion—the type that washes out your seed or creates gullies. The position is stabilised and the task of building up the soil can begin.

Reclamation can be expensive, however, if the land has been allowed to gully seriously, and can cost £5 or more per acre. Where action is taken early enough, it may cost only £2 per acre.

An important point is that these works are capital assets. They are as permanent as the land itself, provided an allowance is made for repairs to be carried out in the same way that you would for your tractor. If you spend £5 an acre on soil conservation works this year, the whole is not a charge against the current crop. In the first place, it is a deduction for income tax purposes. If you are in the 4s. in the pound bracket, the capital cost to you is reduced to £4. From this you can determine the charge against your crop on the basis of a 5 per cent. interest and a 10 per cent. repair charge. This makes an annual charge of 15 per cent. of £4, or 12s. per acre per year.

On the profit side, you'll avoid the periodic loss of seed and poor strikes, and you'll no longer have to plough-in gullies. You will have halted the steady decline in yields that accompanies soil erosion. In all, soil erosion could cost you £1 to £5 an acre per year depending on the severity of the problem. Yet this loss can be avoided for a capital outlay of £2 to £5 an acre, representing an annual cost of 5s. to 12s. an acre.

That's not much to pay for stability, assured productivity and peace of mind. A farm tractor costs at least as much as this per acre in interest, depreciation and repairs—and a tractor is easier to replace than topsoil.

POISONING OF FOXES.

By N. McD. SMITH (In the "Cane Growers' Quarterly Bulletin").

Successful poisoning of foxes over a long period depends on frequent changes in the method of baiting, and the type of material used for bait.

At Bundaberg, damage to canefields from the pest fluctuates considerably, depending on the season. Some farms, however, receive regular attention from foxes, and losses of economic amounts occur in fields of Q.50, which is the variety most favoured for attack. Trapping has never been tried to any extent, but in 1953 an interesting protective measure, using an electric fence, gave excellent results. Three strands of plain wire were rigged at intervals up to two feet from the ground and an electric impulse outfit, similar to the usual electric fence set up, provided "live wires." The enclosed field was satisfactorily protected and a pad around the fence was easily seen where the animals had scouted the barrier, seeking a break. However, this method offered only individual protection and resulted in greater damage to other fields. Therefore, baiting with strychnine offered the best chances of eliminating damage.

As mentioned previously, a change in bait is all important, and fish was found to be more enticing than partly cooked pork, raw sheeps' tongues, raw kidney and fowl.

The method of preparing the fish was to obtain bodies from which fillets had been removed and cut each into three sections—head, middle and tail. The pieces were then placed in the freezing chamber of a domestic refrigerator until frozen solid. On removal the pieces were separated and one small cut made in a fleshy part of each bait. Three to four grains of the crystal form of strychnine were placed in the cut and the baits distributed partly buried in the ground while they were still in the frozen state. The advantage claimed for the freezing was that thawing removed much of the smell of human handling and rendered the fox less suspicious.

The take of baits will decrease after a short while and a change of material will be necessary. Fowl carcases are rated next to fish, according to local experience, and the three to four grains of strychnine are introduced into an incision at the head and at the tail. There appears to be a better killing effect if the body is warm at the time of poisoning. However, a check on kill is difficult to assess using fowl bodies, for the fox often removes a large food piece to a harbourage where it is eaten at a later date.

Concerning other attractive bait material, there are many variants, and trials will establish something which will be temporarily satisfactory. A case comes to mind of an animal which avoided all classes of bait, but eventually succumbed to rotten eggs which were buried with very little cover near the regular track into the canefield.

Placing of baits involves a knowledge of animal tracks into the farm and can be determined by an inspection of headlands, etc., for paw marks and lining up damaged cane patches with likely harbourages. The number of baits laid must be counted for safety's sake and also to learn when to change to something different when the take drops off and damage still occurs. The number laid over an area depends on variable factors, but the distance apart for fish baits is every three to four paces in an area of damaged cane.

Where poisoning is being carried out it would be advisable to display a notice to this effect in conspicuous places on the farms concerned, and as an act of courtesy, neighbouring growers should be advised to chain up their dogs. The strictest precautions should also be observed in storing the poisons and baits away from the reach of children.

The Long Bean

By L. J. MISSINGHAM, Adviser in Horticulture.

In coastal Queensland, it is particularly difficult to grow French beans during the late summer months when temperatures are high and rainfall excessive. Consequently, if for any reason the Stanthorpe crop fails, a shortage of beans is experienced at this time of the year, particularly in northern parts of the State.

Substitute for French Bean.

A close relative of the cowpea commonly known as the long bean or snake bean is a very good substitute for the French bean. This leguminous plant thrives only in the hottest months of the year, and it stands up well to bean fly attack.

The long bean is not grown as extensively as its bearing habits and the eating qualities of the pods warrant. A dozen plants established in the home garden every three weeks or so will provide an ample supply of much-needed green vegetables during the late summer and autumn months.

In some quarters there seems to be a prejudice against the long bean, possibly because the flavour is quite distinct from that of the French bean. Nevertheless, the best varieties are quite palatable when picked at the correct stage of maturity and properly cooked. The addition of salt, pepper and butter enhances the flavour; on the other hand, overcooking destroys the flavour of the pods and reduces their nutritive value.

Varieties.

Three varieties of long bean are recognised in North Queensland and, to a lesser extent, in southern Queensland. None of them are named, but each is characterised by the colour of the mature seed, the length and flavour of the pods and slight differences in the plants themselves.

Perhaps the best of the three is a brown-seeded variety which bears a fleshy pod about 18–20 in. long. Another variety grown from a cream and brown coloured seed produces shorter pods of similar quality. It is the earliest maturing of the long beans, and the plant is relatively small and often grown as a bush without staking. A black-seeded variety with a pod up to two feet long has a slightly astringent flavour and tends to become papery very quickly.

All varieties produce a crop in 6–8 weeks from the time of planting and picking continues over a period of six weeks or more.

The pods are borne on flower stalks which arise in the axils of the leaves on the main stem. Those which are close to the stem mature first; when they are ready for picking, they should be nipped off with the finger and thumb or twisted away from the stem so as not to injure the younger pods and flowers.

The pods are, of course, harvested when they are young and succulent, with very soft seeds.

Land Preparation.

Long beans will grow on a wide range of soil types, but well-drained loams with large amount of decomposed organic matter are most suitable for the crop. The initial ploughing or, in garden areas, spading should be

about 9 in. deep and the work should be done at least six weeks before the scheduled date of planting.

Most coastal soils are highly acid and the crop benefits from liming. Agricultural lime or dolomite may be broadcast over the land at a rate of 2 tons per acre (equivalent to 4 cwt. per square chain or 1 lb. per sq. yd.), or applied in the planting row at the rate of about 20 lb. to the chain row.

Plate 1.

Long Bean Grown on Trellis. When picked young, with very soft seeds, the pods make an excellent summer vegetable.

It should be incorporated into the surface soil at least a month before planting.

A liberal dressing of well-rotted fowl or other manure can be worked into the ground before planting. If fowl manure is not available, the land may be fertilized with a 4:15:2 or similar complete mixture applied at a rate of 1½–2 lb. per chain row. The fertilizer should be placed in the bottom of the drill, worked into the soil with a fork hoe and covered with an inch or so of soil a few days before the seed is planted.

Planting.

The long bean grows well only in the hot months. The planting season therefore extends from September to early March in North Queensland and from September to early February in the South.

The seed is sown approximately 1 in. deep at spacings of about 10 in. in the row. The row spacing for single-row planting is 3½ ft. and for double-row planting 2 ft., with 5½ ft. centres.

The seed may be planted in drills about 6 in. deep. The drill is gradually filled in with a prong hoe as the plants grow in order to smother small weeds. This method of cultivation eliminates much tedious hand-weeding which is unavoidable when the seed is planted on level ground. The drill is completely filled in after three cultivations and this is usually sufficient for the life of the crop. If more weeds appear, they may be smothered by hilling.

Supporting the Vine.

The long bean is a climbing plant and needs to be staked or provided with some other support. In the home garden, the vine is usually grown on bush or 1 in. by 1 in. hardwood stakes about 7 ft. long driven into the ground near the base of the plants. The stakes are commonly tied together at the top to increase their stability during periods of heavy wind.

The long bean may also be grown commercially on trellises such as those used for the tomato crop in southern Queensland. Perhaps the most suitable type of trellis consists of binder twine strung between two wires which are tightly drawn between well-stayed posts at the end of each row. The wires are supported between the end posts by hardwood droppers spaced at 10 ft. intervals.

For long beans, the bottom wire could be about 1 ft. from the ground and the top wire about 6 ft. high. The twine would be strung between the wires with the point of each V accommodating two long bean plants.

The plants need very little training on this type of trellis to control growth of the vines. Provided the seeds are sown 1 ft. apart, and the trellises suitably spaced, picking would be quite simple.

VIGILANCE AGAINST PULLORUM DISEASE.

Although pullorum disease is no longer a problem in chick rearing in Queensland, continued bloodtesting of all birds in breeding flocks is a necessary insurance against a build-up of the disease, the Minister for Agriculture and Stock (Hon. O. O. Madsen, M.L.A.) said recently.

Twenty-five years ago, pullorum was one of the most serious diseases of chickens and often accounted for losses of 60 per cent. or more. Since that time, a method of control by bloodtesting the parent breeding birds has been applied, for the disease is transmitted from adult birds through the eggs to newly hatched chickens.

This testing enabled "carriers" to be detected and removed, thus attacking the spread of disease at its source.

Some commercial poultry breeders of long standing can recall when up to 40 per cent. of their flocks were "reactors" at the first bloodtest.

Of the 139 breeding flocks tested in Queensland this year, 84 were completely free from "carriers." Ten years ago, some of these same flocks had 5 per cent. or more "carriers."

In the early days of bloodtesting, only the breeding birds on hatcheries were bloodtested, but in 1948 the bloodtesting scheme was enlarged to include all birds on the farm over four months of age. The percentage reaction for the State was over 5 per cent. This year, of the quarter of a million birds tested by officers of the Department, fewer than 400 were removed as "carriers."

QUEENSLAND TRIALS ON RUSSIAN COMFREY.

Russian comfrey, a new fodder crop to Queensland, is being tested under field conditions by the Department of Agriculture and Stock. Later this year, large-scale trial plantings are planned for the Darling Downs, Callide Valley and Atherton Tableland.

Mr. V. J. Wagner, Chief Agronomist in the Department, said recently that the promise of high yields of protein-rich fodder has stimulated farmers' interest in the crop. Reports from overseas mention yields from mature plantings of 100 tons an acre per year, with a protein content of up to 25 per cent.

However, the crop has not yet been grown on a large scale in this State and very little is known of its performance under Queensland conditions. It does not seem suitable as a grazing crop, as stock would trample and damage the crowns. It also appears to be too succulent for mechanical harvesting. Cutting with a reaping hook or scythe may therefore be necessary.

Three varieties introduced by the C.S.I.R.O. have been planted by the Department at the Redlands Horticultural Experiment Station and these varieties—Bocking 4, Bocking 14 and Bocking 17—are being multiplied to provide planting material for larger trials. In proposed bigger plantings at the Hermitage, Biloela and Kairi Regional Experiment Stations, Russian comfrey will be tested in both yield and feeding trials during the coming season.

From plots at the Redlands Station, yields from two cuttings taken in the first five months of growth were at the rate of 11 tons of green material to the acre. On a dry basis it was found to contain up to 24 per cent. of protein. Its high protein and low fibre level point to its use as a protein concentrate rather than as a pasture.

Some of the harvested material was used in a palatability trial with sheep. These tests showed that shade drying for 24 hours approximately doubled its palatability.

Russian comfrey is a sprawling plant with long, broad, fleshy leaves growing from a large crown. Plants grown in Queensland have so far been about 12 to 14 inches high and about 42 inches in diameter. It is grown from root sections and is ready for the first cutting about 12 weeks after planting. For best results, Russian comfrey requires ample water and plant foods.

Mr. Wagner said that Russian comfrey may be difficult to eradicate once it has become well established, especially if a run of good seasons is experienced. He warned that, until simple eradication has been proved possible, the plant should be regarded as a potential weed. This possibility should be considered before the plant is introduced into valuable cultivations which might be wanted later for other crops.

KEEPING EGG YOLKS YELLOW.

Stabilised vitamin A preparations have largely replaced green feed as a source of vitamin A in poultry rations. This trend has brought with it a new problem: the eggs have pale yolks instead of the golden yellow yolks housewives prefer.

Poultry Advisers in the Department of Agriculture and Stock are now recommending a way out. When you're using a vitamin A supplement instead of green feed, make sure the laying ration contains 5 per cent. of good quality lucerne or 15 to 20 per cent. of yellow maize.

Notes on Soils and Fertilizers

By Officers of the Horticulture Branch.

Soil may be defined as disintegrated and more or less decomposed rock material intermingled with organic matter from plant and animal remains The mineral matter is derived from the parent rock by physical and chemical processes which operate together and are covered by the term "weathering."

Mechanical disintegration of rocks may be brought about by the physical action of wind, water, ice, temperature changes, fire, plants and animals. Wind, when charged with mineral particles, becomes a sand blast which causes abrasion. Water carrying mineral particles not only has a scouring action but transports products of weathering from place to place. Water in the cracks and crevices of rocks expands when frozen into ice and the pressure tends to fracture rock material. The effect of temperature changes on rock disintegration is not great but the alternating expansion and contraction associated with large diurnal variations in temperature over long periods causes some fracturing. Fire has a similar but more immediate effect, particularly in semi-arid areas.

The water associated with rock weathering contains in solution gases such as carbon dioxide as well as the humic and allied acids derived from decaying vegetation. Particularly under warm conditions, solutions of this kind react with most rock minerals, bringing about chemical changes which result in altered end products. Chemical weathering is also brought about by oxidation (addition of oxygen), hydrolysis (addition of elements derived from water) and hydration (chemical combination with water). Clay, which so largely determines the agricultural characteristics of soils, is a product of chemical weathering.

SOIL CHARACTERISTICS.

Soil, which is the normal medium for plant growth, consists essentially of mineral matter, organic matter, water, air and micro-organisms.

Mineral Matter.

The mineral matter of the soil comprises stones, gravel and smaller particles, the smallest of which are clay. The larger fragments are usually undecomposed rock. Excluding the coarse material termed gravel, the soil consists of four fractions, known respectively as (*a*) coarse sand (2·0–0·2 mm. diam.); (*b*) fine sand (0·2–0·02 mm. diam.); (*c*) silt (0·02–0·002 mm. diam.); and (*d*) clay (less than 0·002 mm. diam.).

Clay is the chemically active mineral matter of the soil and stores most of the nutrients required for plant growth. Its physical properties, to a large extent, govern the moisture-holding capacity of the soil. Changes in volume due to variations in the moisture content of the clay fraction (shrinkage and swelling) are responsible for the cracking so commonly seen in heavy soils in dry weather. Clay has plastic and

cohesive properties and a clay soil, if moulded to a shape when wet, will retain that shape when dried and can be broken only by considerable pressure. This characteristic is responsible for cloddiness in some types of soil and also for the small aggregates which are typical of others.

Organic Matter.

The term "organic matter" usually includes undecomposed surface litter, plant and animal residues in various stages of decomposition, and humus.

Litter consists mainly of fallen leaves and twigs. It forms a protective covering on the ground which stabilises soil temperatures and limits the loss of moisture by evaporation. Some of the surface litter is always being incorporated into the soil by worms, insects, fungi and micro-organisms and this supplements the organic matter already present in the soil and helps to preserve its structure. The breakdown of raw vegetable matter to simpler products is brought about partly by chemical means but mainly by the action of bacteria and fungi, which constitute the bulk of the soil micro-flora.

The changes which take place during the decomposition of organic matter may be grouped broadly into oxidative decomposition and humification. In *oxidative decomposition,* the organic matter is oxidised to carbon dioxide and water, a change which is associated with high temperatures, good aeration and an ample supply of moisture in the soil. Under such conditions, large quantities of carbon dioxide enter the atmosphere. In *humification,* some destructive decomposition takes place but a considerable proportion of the organic matter survives in the form of a dark amorphous material, termed humus, which is highly resistant to further decomposition. Humus contains numerous complex organic compounds which appear to include altered lignin and protein, the former being derived from plants and the latter from either plants or the soil micro-organisms associated with them during decomposition.

The addition of organic matter to the soil may improve its fertility in various ways. Some of the carbon dioxide released as it decomposes dissolves in water, forming carbonic acid. This acid reacts with insoluble calcium, potassium and other rock minerals and converts them into compounds which can be taken up by plants. The balance of the carbon dioxide escapes into the atmosphere, from which it is later extracted by the leaves and other green tissues of growing plants and converted into starch during photosynthesis. Ammonia is also set free during the decomposition of organic matter, and may be absorbed directly by plants or converted to nitrates by micro-organisms in the soil and then used by plants.

Partly decomposed organic matter in the soil provides channels for the free downward movement of water, and the humus which is derived from it assists in the aggregation of soil particles and so improves its structure. In light-textured soils, the greater the amount of humus present, the greater is their capacity to absorb and retain moisture for use by the growing crop.

Humus is an organic colloid and takes part in many chemical reactions within the soil. It is very largely responsible for the retention in the soil of plant foods such as potassium, calcium, magnesium, ammonia and phosphorus, which would otherwise be lost in drainage water.

Water.

Soil which has been heated in an oven to 105 deg. C. until its weight remains unchanged is known as oven-dry soil. Oven-dry soil, if exposed to air, absorbs moisture, the amount depending on the temperature and humidity of the atmosphere. The moisture so absorbed is firmly held in the clay fraction of the soil and in the organic soil colloids, and is not available to plants.

Any water added to the soil after the mineral colloids and organic colloids are saturated is distributed as a film on the surfaces of the particles and crumb aggregates. These particles and crumbs are variable in shape and size, with irregular spaces between them. The smaller the average pore size, the more tightly does the soil hold water. Water which is retained under conditions of free drainage is known as *capillary water*; water which drains through the larger pore spaces is termed *gravitational water*.

Air.

The air in the soil differs from that in the atmosphere. Usually its carbon dioxide concentration is higher, its oxygen content is lower, and it is more or less completely saturated with water vapour. Some air movement takes place by diffusion, both within the soil and between the soil and the atmosphere, and the composition of the soil air therefore varies with depth. Variations in the composition of the soil air are also caused by seasonal changes in micro-biological activity. Minor daily changes are sometimes associated with changing atmospheric pressures, temperatures and winds.

Soil Micro-organisms.

Soil micro-organisms occur in all cultivated soils. Many bacteria and fungi attack the remains of plants and animals, breaking down complex organic compounds to simpler substances and at the same time liberating plant nutrients such as calcium, potassium and phosphorus. Most of the chemical reactions involved in the process ultimately produce substances which are beneficial to the growing plant.

Some micro-organisms live in association with the roots of living plants. Of these, the mycorrhizal fungi, which are best known on exotic pines, and the nodule bacteria found on leguminous plants, are the most important.

Soil Classification.

A vertical section through a soil from the surface down to the parent material is termed a soil profile. It can usually be subdivided into a number of horizons or layers of soil with well-defined characteristics and lying approximately parallel to the ground surface.

During the process of soil formation, percolating waters carry some materials downwards and their redistribution finally reaches a state of equilibrium with the prevailing climate. Several horizons are then usually distinguishable in the profile. The zone from which materials are removed by leaching is called the "A" horizon; the zone into which they have been deposited is the "B" horizon; the

weathered parent material is the "C" horizon; and the unweathered parent rock or alluvium is the "D" horizon. The "A" horizon is usually dark in colour owing to the accumulation of organic matter, and the "B" horizon has a relatively high clay content. Substances removed from the "A" horizon by leaching are clay, saline matter (sodium, magnesium and calcium chlorides, calcium sulphate, magnesium and calcium carbonates) and oxides of aluminium, manganese and iron.

Principles of Classification.

Soil classification is a system of grouping soils on a basis of common properties.

Details of the profile are necessary for the definition of a soil type. These include the number of horizons, their colour, texture, structure, arrangement, thickness and chemical composition, and the nature of the parent rock from which the soil has been derived.

According to the system of classification used, there are 40–50 great soil groups. Each of these is subdivided into smaller units, three of which, the series, type and phase, are commonly recognised in the field. The soil series is a group of soils which have the same arrangement of horizons in the profile and are developed from the one kind of parent material; the thickness and other characteristics of the horizons on the profile of a given series do not differ significantly, but the texture, particularly in the "A" horizon, is variable. A soil series may contain one or several soil types in each of which the "A" horizon (the surface soil) has a distinctive texture. The soil type, in turn, may have several phases, the phase defining those characteristics which are important in land use; thus within a type there may be a steep phase, a stony phase and a shallow phase.

PHYSICAL PROPERTIES OF THE SOIL.

The most important physical properties of the soil are texture, structure, consistence, colour and water-holding capacity.

Texture.

Texture describes the soil in terms of the coarse and fine particles in it. It may be assessed in the field by first rubbing the dry soil between the fingers and then moistening the sample with water to determine its plasticity. Soil texture is usually indicated by terms such as sand, sandy loam, loam, silty loam, clay loam and clay.

In a *sand,* the individual grains can easily be seen and felt; when moist, a cast crumbles easily. The individual sand grains can also be seen and felt in a *sandy loam,* but the silt and clay content is sufficient to give some stability to a cast made from the moist soil. A *loam* contains sand, silt and clay in such proportions that none of the fractions is easily distinguished by sight or feel; the dry soil runs easily through the fingers but the moist soil feels smooth (not sticky) and a cast can be handled quite freely without breaking. A *silty loam* contains a fair amount of fine sand, very little clay and more than 25 per cent. of silt; the soil has a soft, floury feel and when moist is soft to the touch, not sticky; a cast made from the moist soil can be

handled freely, but excess water causes puddling. When dry, a *clay loam* is inclined to be cloddy unless the organic matter content is high; when moist it is slightly sticky and a thin ribbon formed under pressure between the fingers breaks easily; the cast of moist soil is quite stable. *Clay* soils are usually lumpy when dry and sticky when wet; a thin ribbon of moist soil is quite flexible and can frequently be bent into a circle without breaking.

Any of these types of soil may contain an appreciable amount of stone, gravel, or sand, and this characteristic is emphasised in such terms as *gravelly loams* and *sandy clays.*

Structure.

The structure of a soil is determined by the arrangement of the individual particles in compound units or aggregates. *Crumb-structured* soils contain irregularly shaped aggregates which are seldom more than $\frac{1}{2}$ in. in diameter and reasonably stable. *Mealy* soils possess very soft aggregates which are $\frac{1}{5}$ in. or less in diameter. In *granular* soils the aggregates are similar in size and stability to those of crumb-structured soils but less irregular in shape and somewhat rounded. The aggregates in *lumpy* soil are $\frac{4}{5}$ in. or more in diameter and fairly stable. *Cloddy* soils contain aggregates which are angular, 2 in. or more in diameter and very stable. In *nutty* soils, the aggregates vary in size from $\frac{1}{5}$ to $\frac{4}{5}$ in. in diameter, are somewhat rounded in shape and are fairly stable. *Massive* soils are characterized by aggregates without any consistent pattern, and *single-grained* structured soils are entirely devoid of aggregates. Other terms in common use are *platy* (arranged in horizontal layers), *prismatic* (prism-like) and *columnar* (prism-like with rounded ends.)

Consistence.

The consistence of a soil depends on the cohesive quality or stability of the aggregates, and may be described by such terms as loose, soft, compact, hard and plastic. A *plastic* soil does not rupture easily and is quite pliable.

Soil Colour.

The colour indicates certain characteristics in soil. A dark colour in the surface soil is usually due to the presence of humus, while a light colour is often associated with intense leaching and low fertility. Red soils, which are widely distributed throughout Queensland, sometimes become infertile after they have been cropped for a few years, and their usefulness is primarily due to their good drainage, which simplifies cultural operations, and their response to good management. Many good horticultural soils have a reddish subsoil which is indicative of good drainage; soils with a mottled red, yellow, or grey subsoil are often subject to periodical waterlogging.

Water-holding Capacity.

There is a limit to the amount of water which a well-drained soil can hold. If a soil is thoroughly soaked by rain or irrigation, the loosely held gravitational water moves downwards under the action of gravity. After one or two days, when no further movement takes

place, the soil is said to be at *field capacity,* and contains the maximum amount of water available to plants. The soil then becomes progressively drier as a result of losses from evaporation and/or consumption by plants. Eventually, the soil moisture content drops to a level at which the plants wilt and do not recover at night even in a saturated atmosphere. A soil in this condition is said to have reached its *wilting point.* Most of the soil water between wilting point and field capacity (the capillary water) can be used by plants.

The amount of moisture held by a soil at field capacity and at wilting point varies with its texture, structure and organic matter content. A heavy soil has a relatively high field capacity and a high wilting point, and once it has dried out well below wilting point, plant growth cannot take place until substantial rains have fallen. On the other hand, a sandy soil has a low field capacity and a low wilting point; in this type of soil, water from a light shower is almost immediately available to the plant and a quick growth response occurs.

CHEMICAL PROPERTIES.

At least 15 chemical elements are essential for plant growth. They are carbon, hydrogen, oxygen, phosphorus, potassium, nitrogen, sulphur, calcium, magnesium, iron, manganese, molybdenum, copper, zinc and boron. The first three of these elements are obtained from air and water; the remainder have to be absorbed from the soil. An exception occurs, however, in the case of leguminous plants which obtain nitrogen from symbiotic bacteria associated with their roots. Some other elements, such as sodium, chlorine and silicon, though not essential, are beneficial to certain plants.

Nitrogen.

Organic matter, which is an important source of nitrogen used by plants, varies a great deal in composition. When attacked by micro-organisms in the soil, the sugars and starches in it are rapidly decomposed, but the plant proteins break down rather slowly, yielding carbon dioxide and ammonia as the main end products. The ammonia is converted to nitrite by a specific bacterium (*Nitrosomonas*) and the nitrite in turn is oxidised to nitrate by another organism (*Nitrobacter*). As these organisms are most active in a moist soil at moderately high temperatures, soil nitrate levels show seasonal variations.

Nitrogen-fixing bacteria are another source of nitrogen. The most important of these belong to the genus *Rhizobium* and live in symbiotic association with leguminous plants, forming nodules in the roots. Nitrogen is absorbed directly from the air by these organisms and converted in the root nodules to a form which can be used by the plants. These bacteria have been divided into strain groups according to their host plant relationships. A strain which is effective in a specific leguminous crop must be present in the soil for optimum growth of that crop. This can be assured by inoculating the seed with a culture of the appropriate strain before planting.

Small amounts of nitrate in the soil are also derived from oxides of nitrogen produced in the atmosphere during electrical disturbances and later carried into the soil by rain.

Growing crops take up a great deal of soil nitrogen and a certain amount is leached from the soil as nitrates. In some soils there is a further loss from the conversion of nitrate back to elementary nitrogen by denitrifying bacteria. Under natural conditions, an equilibrium is reached between gains and losses. However, when soils are intensively farmed, it is necessary to add nitrogen in some form or other in order to maintain yields. This is done by using nitrogenous fertilizers.

Phosphorus.

Both inorganic and organic forms of phosphorus occur in the soil. Apatite and apatite-like minerals containing phosphates are the usual source of inorganic phosphorus. Calcium compounds in the soil react with these phosphates to form soluble compounds which can be used by plants. Iron and aluminium phosphates are usually present in acid soils but they are insoluble and therefore largely unavailable to plants.

Organic phosphates contained in plant residues may account for up to one-third of the total phosphates in the surface soil. The precise nature of these organic phosphates is uncertain; some are readily available to plants and others are not, but all can be used when the organic matter in the soil is decomposed by micro-organisms.

On some soil types (for example, the red-brown loams) only a small part of the phosphorus added to the soil in fertilizers can be used by the crop; the remainder is immobilised by the iron and aluminium in the clay fraction—a process known as phosphate fixation.

Potassium.

The principal sources of potassium in the soil are rocks containing micas and felspars. In clays derived from these minerals by weathering, the potassium is held in a form that can be used by the growing plant. Reserves of potassium in the soil are limited, and when continuous cropping is practised it is usually necessary to apply potash-rich fertilizers at regular intervals.

Other Elements.

Calcium occurs in the mineral components of the soil as calcium carbonate, calcium sulphate, calcium phosphate and in other forms. In horticultural practice, any shortage of calcium in the soil can be corrected by dressings of lime.

Magnesium occurs in the clay fraction of the soil. In acid soils which have been heavily leached, deficiencies of this element may occur.

Little or no free sulphur is found in the soil, but sulphates are common. They are derived from oxidation of the metallic sulphides which occur in rocks. Plants take up the sulphates and use the sulphur for the synthesis of many proteins found in the tissues. Superphosphate contains a considerable amount of calcium sulphate, and deficiencies of sulphur are unlikely to occur when this fertilizer is used at frequent intervals.

Trace Elements.

Only minute quantities of trace elements such as zinc, boron, copper and molybdenum are required in the soil for satisfactory plant growth. Most of them are usually present in reasonable amounts, but on soils that have been intensively cultivated for a number of years, actual deficiencies may occur.

CATION EXCHANGE.

When dissolved in water many substances break up into atoms or groups of atoms which carry electrical charges. This process is called ionization and the atoms or groups of atoms are called ions. The positively charged ions, such as hydrogen, calcium, magnesium and ammonium, are known as cations. The negatively charged ions are called anions, typical examples of the latter being phosphates, sulphates and chlorides.

If soil is shaken up with water the materials in suspension consist mainly of clay particles which are negatively charged. Separate from these clay particles and moving through the solution are positively charged cations. As a clay particle is negatively charged, cations such as hydrogen, calcium, magnesium and potassium are attracted towards it and form a sort of loose sheath around it. These ions are known as exchangeable cations and can be replaced by other cations, the process being known as cation exchange. For example, if a soil is leached with sodium chloride solution, calcium ions in the exchange complex are replaced by sodium ions.

Soil Acidity.

The concentration of hydrogen ions in a substance determines the degree of acidity and is expressed in terms of what is known as the pH scale, which ranges from 0 to 14. The pH of a soil is the same as that of its colloidal fraction. The principal exchangeable cations associated with the colloidal fraction are hydrogen, calcium, magnesium, potassium and sodium. The relative amounts of hydrogen and other ions determine the pH of the soil. Thus as more hydrogen ions enter the colloidal fraction, the soil becomes more acid; if hydrogen ions are replaced in the colloidal fraction the soil becomes less acid.

Most soils have a pH within the range of 4–10. Those in the range 4–5·5 are classed as strongly acid; 5·5–6·5, acid; 6·5–7·5, neutral; 7·5–8·5, alkaline; while those in the range 8·5–10 are strongly alkaline. Most soils used for horticultural purposes in Queensland fall within the pH range 4·5–7, and are therefore strongly acid to neutral in reaction.

Soil acidity may affect plant growth, and strongly acid soils are usually deficient in plant nutrients, particularly calcium and magnesium. Most soils which are strongly acid benefit from applications of lime or dolomite, which, apart from increasing the amount of calcium and/or magnesium available as plant foods, raise the pH of the soil nearer to neutrality. Under intensive cultivation with heavy fertilizer applications and frequent irrigation, most soils soon become more acid in reaction than they were in the virgin state. This is mainly caused by the nitrogenous fertilizer, sulphate of ammonia.

Availability of Plant Nutrients.

Frequently soils contain ample amounts of plant nutrients but these are unavailable to the crop. Many factors affect the availability of nutrients, but the pH of the soil is perhaps the most important. In an acid soil, treatments which increase the pH usually give the plant greater access to such nutrients as nitrogen, phosphorus, potassium, sulphur, calcium, magnesium and the trace element molybdenum. However, as the pH approaches neutrality, the availability of the trace elements iron, copper, zinc and boron may decline.

Organic matter also affects the availability of certain plant nutrients. An ample supply of organic matter may increase the supply of available phosphorus and zinc, while the type of organic matter and its state of decomposition determine the amount of available nitrogen. Peaty soils high in organic matter are frequently deficient in the trace element copper.

The relative proportions of nutrients in the soil may influence the amount of each in the tissues of the plant. An abnormal nutrient ratio in the soil may cause deficiency symptoms to appear. For example, if a plant contains the minimum amount of magnesium for normal growth (for example, because there is only a limited supply in the soil), excess potassium from fertilizer may induce magnesium deficiency symptoms. Similarly, in soils which contain sufficient iron for plant growth, iron deficiency symptoms frequently develop if the manganese content of the soil is high; this phenomenon is quite common in pineapples grown on soil derived from manganiferous quartzites.

ADJUSTMENT OF SOIL REACTION.

Lime and dolomite are applied to the soil mainly to correct acidity but both have other beneficial effects. Chief among these are (*a*) hastening the decomposition of raw organic matter; (*b*) improving the structure of hard, cloddy soils; and (*c*) supplying calcium and magnesium, both of which are essential plant foods.

Neutralising Value.

Commercially, lime is available as agricultural lime (calcium carbonate), burnt lime or quick-lime (calcium oxide), and slaked lime (a mixture of the hydrated oxide and carbonate of calcium). Dolomite is a double carbonate of calcium and magnesium.

These substances do not all have the same power—termed neutralising value—of neutralising soil acidity. The neutralising value of pure calcium carbonate is rated at 100 per cent. and provides a standard for purposes of comparison. If agricultural lime contains impurities, its neutralising value will be less than 100. Burnt lime or quick-lime and slaked lime have a higher neutralising value than agricultural lime. Dolomite generally has a lower value. These differences are, however, not great and in practice seldom influence the choice of materials to be used; more important factors are the original pH and amounts of calcium and magnesium present.

FERTILIZERS.

The major plant nutrients in the soil are nitrogen, phosphorus and potassium, and it is frequently necessary to supply all three to crops in basal fertilizers or top dressings. Fertilizers containing these three plant foods are known as complete mixtures. Complete mixtures are referred to by their grade formulae, which express the percentage of nitrogen (N), phosphoric acid (P_2O_5) and potash (K_2O) in that order. Thus a 5:14:5 mixture contains 5 per cent. nitrogen, 14 per cent. phosphoric acid and 5 per cent. potash. In the fertilizer mixtures marketed in Queensland, the nitrogen is usually in the form of ammonium sulphate and blood, the phosphoric acid in the form of superphosphate and bone, and the potash in the form of chloride (muriate) or sulphate of potassium.

Special mixtures may contain, in addition to the major elements (nitrogen, phosphorus and potassium), one or more of the trace elements copper, zinc, boron and molybdenum. These mixtures are used for some crops on soils which are known to be deficient in trace elements.

Fertilizers applied as basal dressings prior to planting may be broadcast along the rows and scuffled into the soil or applied in the drill and covered over. Topdressings usually contain only water-soluble ingredients and are preferably applied in bands beside the crop row. If the topdressing is followed by irrigation, some of the fertilizer is quickly carried down to the root zone, where it can be used by the plants almost immediately.

Fertilizers Containing Nitrogen.

The amounts of nitrogen in the specifically nitrogenous fertilizers are: sulphate of ammonia, 21 per cent.; sodium nitrate, 16 per cent.; dried blood, 11–13 per cent.; guano, about 13 per cent.; ammonium nitrate, 35 per cent.; calcium cyanamide, 21 per cent.; and urea, 46 per cent.

Although *sulphate of ammonia* is water-soluble it is not readily leached from the soil because the ammonium ion is fixed by cation exchange. Some plants can assimilate ammonia directly but most can only utilise nitrogen in the nitrate form. The ammonium ion has therefore usually to be converted to nitrate by micro-organisms before it can be taken up by the plant roots. Sulphate of ammonia should therefore be applied about a week before the plants require it, so that the conversion to nitrate can take place before symptoms of nitrogen deficiency become apparent.

The fixation of ammonia which follows the application of sulphate of ammonia to the soil is accompanied by the release of calcium. This element combines with free sulphate ions to form calcium sulphate, which is rapidly leached from the soil. Consequently, when sulphate of ammonia is regularly used in large amounts, there is an appreciable increase in the soil acidity. This tendency can, of course, be corrected by occasional dressings of lime or dolomite.

Sodium nitrate is a readily soluble salt which provides nitrate for absorption by the roots as soon as it is applied. Repeated applications of this fertilizer may have a deleterious effect on the soil structure, particularly of clay loams, because of the large amount of sodium which enters into the clay complex.

Dried blood is commonly used to supply part of the nitrogen in complete mixtures. The nitrogen becomes available gradually as the blood decomposes and normally very little is lost by leaching.

Other nitrogenous fertilizers are not commonly used in Queensland.

The ratio of carbon to nitrogen in the soil usually lies between 10:1 and 13:1. If this ratio is disturbed by cropping practices which involve the addition of materials high in either carbon or nitrogen, several factors tend to restore the ratio to its original level. Thus, if carbon is added to the soil in the form of, say, the carbohydrate in straw, microbial activity is stimulated and nitrates are used by soil micro-organisms with a consequent reduction in the amount of nitrogen available for plant growth, so the carbon-nitrogen ratio gradually returns to normal. Conversely, if materials high in nitrogen, such as dried blood, are added to the soil, nitrate is formed by bacterial action. Some of this additional nitrate is lost by leaching, some is absorbed by plants and some is decomposed by denitrifying bacteria, and the carbon-nitrogen ratio of the soil is thus restored to normal.

The nitrogen content of the soil cannot be permanently increased by the addition of fertilizers. It is possible, however, to increase the total amounts of both carbon and nitrogen in the soil by measures which raise the humus content of the soil, for humus has a carbon-nitrogen ratio of 10:1.

Fertilizers Containing Phosphorus.

Superphosphate contains 20·5 per cent. water-soluble phosphoric acid which is readily available to plants. Other sources of phosphoric acid are ground rock phosphate (37 per cent. P_2O_5), meatworks manure (14–23 per cent. P_2O_5) and bonedust (22–23·5 per cent. P_2O_5).

Rock phosphate, most of which comes from Nauru and Ocean Islands, is used in the manufacture of superphosphate; it is finely ground and treated with sulphuric acid, which converts the insoluble phosphates in the rock into water-soluble forms. Soon after it is applied to the soil, superphosphate is converted to a mixture of di– and tri-calcium phosphates. This process is sometimes referred to as reversion, but the reverted phosphates are more readily available than the original rock phosphates. Some of the phosphate is, however, precipitated in the form of iron and aluminium phosphates, which in very acid soils are insoluble and therefore not readily available to the plants.

Bonedust is not water-soluble and must be decomposed by micro-organisms in the soil before the phosphorus can be used by plants. Under warm moist conditions this proceeds fairly rapidly. In certain complete mixtures some of the phosphorus is in the form of superphosphate and some as bonedust. The superphosphate provides an immediate supply of phosphorus to the crop, while that from bonedust becomes available gradually.

Meatworks manure contains 3–6 per cent. nitrogen in the form of dried blood and 14–23 per cent. phosphoric acid in the form of ground bone. If used alone it must be applied to the soil some two or three

weeks before a crop is planted, so that the nitrogen and phosphorus will be available when germination takes place. Meatworks manure should be well mixed with the soil to ensure rapid decomposition.

Fertilizers Containing Potassium.

Two fertilizers are commonly used to supply the potassium requirements of growing crops—sulphate of potassium (48–50 per cent. K_2O) and chloride (or muriate) of potassium (60–62 per cent. K_2O). Both salts are soluble in water, and when they are applied to the soil most of the potassium is absorbed in the clay fraction and very little of the fertilizer is lost by leaching. Potassium is most conveniently applied to the soil as a constituent part of a complete mixture.

Fertilizers Containing Magnesium.

Dolomite is a common source of the magnesium required by plants. If the soil is acid and known to be deficient in magnesium, applications of dolomite are generally beneficial. Magnesium may be applied in the form of magnesium sulphate (Epsom salts) to non-acid soils.

Trace Elements.

Plant disorders due to trace element deficiencies in the soil can be corrected by either sprays or soil dressings. Treatment schedules are listed below and vary in practice from crop to crop.

Deficiency.	Treatment.	Crop.
Iron ..	Foliage spray (1 lb. ferrous sulphate, 3½ gal. water)	Pineapples
Zinc ..	(*a*) Foliage spray (10 lb. zinc sulphate, 5 lb. hydrated lime, 100 gal. water)	Citrus
	(*b*) Dormant spray (20 lb. zinc sulphate, 80 gal. water)	Pome and Stone Fruits
Boron ..	(*a*) Foliage spray (5 lb. borax, 100 gal. water)	Citrus and Pome Fruits
	(*b*) Soil dressing (10–30 lb. borax per acre) ..	Citrus, Cauliflower and Beet
Copper ..	(*a*) Foliage spray (4 lb. copper sulphate, 4 lb. hydrated lime, 40 gal. water)	Citrus and Pome Fruits
	(*b*) Soil dressing (10–40 lb. copper sulphate per acre)	Citrus and Pome Fruits
Molybdenum	Foliage spray (1 oz. sodium or ammonium molybdate, 10 gal. water)	Beetroot, Lettuce, Cucurbits and Crucifers

GROW YOUR OWN BUFFEL GRASS SEED.

Seed of the Gayndah and Biloela strains of buffel grass is scarce again this season.

Mr. S. Marriott, Chief Agrostologist, Department of Agriculture and Stock, suggests that graziers who plan to make extensive plantings of this grass next season should take steps now to secure their own seed supply. Until commercially produced seed is in full supply, the answer for the man sowing hundreds of acres is home-grown seed. If you fence off a few acres and reserve them as your seed plot, you can expect to harvest 50 to 100 lb. of seed to the acre, depending on the density of the stand and the efficiency of seed harvesting.

The Pine Bark Anobiid

By A. R. BRIMBLECOMBE, Senior Entomologist.

The pine bark Anobiid (Ernobius mollis **(L.))** **has been intercepted on several occasions in recent years by Queensland quarantine officers but is now recorded for the first time in this State from locally grown timber.**

This insect is a native of Europe, where it is most common in Scandinavian countries, and is present in the United States of America, New Zealand, South Africa and South Australia.

Life Cycle.

Adults of the pine bark Anobiid are small reddish-brown beetles (Plate 2) up to one quarter of an inch in length. The head is reflexed downwards and almost hidden, but the eyes can be seen from above. The antennae are about half as long as the body and consist of 11 segments, of which the three terminal ones are longer than the others. The prothorax is somewhat triangular but broadly curved above, wider than long, with the apex rounded. The elytra (wing cases) are wider than and three times as long as the prothorax, of a shining appearance and covered with numerous fine hairs.

Plate 2.

Pine Bark Anobiid. (After Cann.)

The small white eggs, after an incubation period of two to three weeks, hatch into creamy white larvae which when fully grown are stout, curved in shape and up to one quarter of an inch in length (Plate 1). The body has numerous short golden stiff hairs, with bands of short brown spinules on the third thoracic segment and extending across the first nine abdominal segments, with a group on either side under the tenth segment.

Plate 1.

Larva of the Pine Bark Anobiid, Showing Body Spines. (After Munro.)

The larvae require eight to nine months to become fully grown and then change to pupae in small oval cells. After a lapse of about two weeks these transform to beetles, which bore their way to the exterior, making small round holes one-tenth of an inch in diameter (Plate 4).

In overseas countries there is normally one generation each year, but in South Africa two generations occur occasionally.

The pine bark Anobiid is related to and resembles the European furniture beetle (*Anobium punctatum* (De G.)), which in Queensland is found occasionally in the southern part of the State. It differs from this species, which is illustrated in Plate 3, in not having an excavation for receiving the head under the prothorax or longitudinal grooves and punctures on the elytra. The larva of the European furniture beetle has only eight bands of spinules and none on the tenth segment.

Plate 3.

European Furniture Beetle. (After Cann.)

Habits.

The beetles emerge mostly in the spring or early summer. Usually they are active after dusk, although sometimes they may be seen crawling about during the daytime. When disturbed they fall and feign to be dead. The beetles can fly freely and so quickly extend areas of infestation.

Females search for dead branches or trees, felled logs or dry timber, with the bark still present, and lay eggs in crevices or under loose pieces of bark. The young larvae bore through the bark, mostly to the cambial region, where they tunnel in an irregular manner (Plate 4) for a distance of one or two inches.

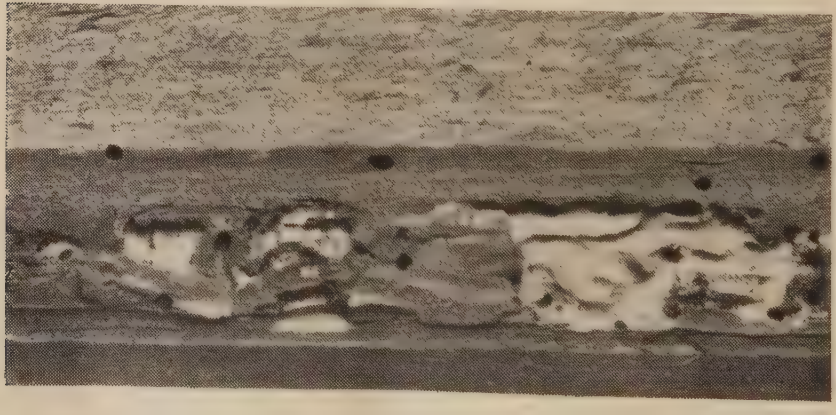


Plate 4.

Pine Timber Showing Larval Tunnels and Adult Emergence Holes.

The tunnels are enlarged as the grubs grow, leaving an engraving on the inner bark surface and on the surface of the wood; and are loosely packed with coarse dust comprising excrement and fragments, brown or white depending on whether feeding occurs on bark or wood. Tunnels may be confined to the bark if this is thick; they rarely penetrate the wood.

Timber Attacked.

The pine bark Anobiid attacks only species of *Pinus*. Living trees and green wood are not attacked, but immediately the greenness has passed, whether of branches, felled trees or sawn timber, attacks are likely. Stored timber with pieces of bark intact may also be attacked.

Control.

The presence of bark is essential for initiation of infestation and for larval development. Removal of bark from logs and sawn timber therefore precludes any need for further control of this borer. The use of timber with bark on can be the source of damage by emerging beetles boring through ply, veneer or other important materials overlying the infested wood.

If this insect should become widespread in Queensland every effort should be made to remove bark from timber of *Pinus* species before it is used. Superficial chemical treatments, which at all times are inconvenient, will then be necessary only to arrest damaging infestations.

ANTIBIOTICS FOR DISEASE PREVENTION.

Antibiotic drugs are now available for veterinary purposes at prices low enough to justify their use, says Mr. B. Parkinson, Divisional Veterinary Officer, Department of Agriculture and Stock, Maryborough.

During the last 10 years or so, the range of antibiotic drugs has been extended considerably. Some of them have given promising results as feed supplements to increase growth rates. Now, antibiotics added to the feed are proving equally valuable in preventing disease outbreaks reaching severe proportions. For this purpose, they are fed at a higher rate than that used to stimualte growth.

In the field, antibiotic feeding has given some very good results in preventing the spread of outbreaks of disease. This method of disease prevention appears to have a definite place in rearing pigs and calves.

The use of oxytetracycline in the feed has proved itself in dealing with outbreaks of pneumonia and scours in pigs. When this drug is fed immediately symptoms of the disease are noticed, the outbreak is usually prevented from spreading and only a few pigs are affected. Sick pigs, of course, should always be removed from the pen and treated individually. On the other hand, if only the sick pigs are treated and antibiotics are not fed to the rest of the pen, 50 per cent. or more of the pigs may go down with the disease.

The saving through feeding antibiotics in this way is considerable. The disease causes very little check in the pigs' growth, and fewer have to be treated at the more costly full dose rates.

The rate of antibiotic feeding is about four to six times as great as that used for increasing the growth rate. This is, however, only one-quarter to one-sixth of the dose used to treat sick pigs. In a disease outbreak, antibiotic feeding is continued for seven to 10 days. For details of antibiotic feeding for disease prevention, consult your local Veterinary Officer.

The Banding of Wild Duck in Queensland

By C. ROFF and H. J. LAVERY.

Wild ducks are our most important game birds, and the Queensland Department of Agriculture and Stock is responsible for the care of this natural asset.

For many years these birds have been protected by close seasons and the provision of sanctuaries throughout the State. In effect, the legitimate needs of sportsmen have been met but at the same time fauna conservation has not been neglected.

In some areas, however, the draining of more swamps has destroyed the natural haunts of our waterfowl; the number of duck shooters is increasing; faster transport has opened up districts previously remote; and generally there is increased leisure time. All these factors are having some effect on wild duck populations. Accordingly a long-range programme of further studies of our ducks, including a banding project, is being undertaken by Departmental Officers.

Plate 1.

Aluminium Duck Bands as Used by the Queensland Department of Agriculture and Stock.

Plate 2.

A Maned Goose (Chenonetta jubata **Latham**) **being Banded, Beenleigh, February, 1957.**

Plate 3.

Black ducks (Anas superciliosa **Gmelin**) **in Trap at Seventeen Mile Rocks, June, 1957.**

Every year a large number of ducks will be trapped, banded, and then released. Each band, placed on the leg of a duck, will bear the inscription "NOTIFY AG. & S. DEPT. QLD.", and a serial number.

The success of this project depends on the return of bands to the Department.

Shooters and others are therefore asked to forward bands from dead wild ducks, and information on the time and place of the find, to the Fauna Officer, Department of Agriculture and Stock, Brisbane, Queensland. If a banded duck is captured alive and then released, the band should not be removed, but relevant information on the capture would be appreciated.

RESEARCH WORK ON STRAWBERRY GROWING.

The last five years' research into strawberry growing in Queensland was outlined by Mr. K. M. Ward, Senior Horticulturist, Department of Agriculture and Stock, at a recent field day.

Speaking to a gathering of 240 at the Redlands Horticultural Experiment Station, Mr. Ward said the work had covered plant nutrition, mulching, time of planting, improvement by plant selection and weed control.

Strawberry plants are sensitive to the proportion and amount of plant foods supplied to them. Excess nitrogen reduces the yield and produces soft fruit which breaks down quickly after picking.

Side dressings of a quick-acting fertilizer are necessary to maintain growth and fruit production over a long period and to stimulate the growth of strong runners. With inadequate potash, fruit quality and yield may suffer. Moderate amounts of phosphorus apparently are sufficient for the strawberry plant. Experiments on fertilizing strawberries are still in progress, and no changes in existing recommendations are contemplated unless the final results show that they are necessary.

Research on weed control indicates that several chemicals may be useful for this job. A pre-planting spray to destroy weeds at or soon after germination appears to be available in Chloro I.P.C. For weed control during the growing period, 2,4-D ethyl sulphate shows promise. It is, however, too early to make recommendations.

In view of the shortage of tan bark for mulching, a number of alternative materials are being examined. Among these are black plastic sheeting, wood shavings and sawdust. Black plastic is completely effective in suppressing weeds and if suitably perforated it allows water and fertilizer applied in side dressings to reach the roots. Wood shavings appear to be just as effective as tan bark, but they must not come from wood that has been treated with borax.

An experiment on the time of planting runners has emphasised the importance of planting in the first half of March. It has been shown that a delay of four weeks in planting results, by October, in a reduction of over 50 per cent. in the amount of fruit produced.

Plant selection work has proved that there are strains of Phenomenal strawberry plants which are more vigorous and productive than others.

Chronic Respiratory Disease (C.R.D.) in Fowls

By P. D. RANBY, Veterinary Officer.

Chronic respiratory disease appears to be widespread in poultry in Queensland and is of considerable economic importance. It is one member of a group of respiratory diseases occurring in the fowl. These diseases form a rather confused group due to the similarity in symptoms resulting from the different causative agents involved.

CAUSE AND SPREAD.

The cause of C.R.D. is still in some dispute but it seems likely that a minute pleuro-pneumonia-like organism (P.P.L.O.) plays an important part.

Like other respiratory diseases caused by infectious agents, C.R.D. can be spread by direct contact either with actively infected fowls or with "carrier" fowls which have not completely thrown off the infection resulting from a previous attack.

Recent investigations strongly suggest that the C.R.D. causative agent can pass through the egg, remain dormant in the newly hatched chicken for some months, and then become active. When chickens obtained by incubating eggs from affected hens were reared in isolation they developed C.R.D. several months later.

Turkeys are susceptible to the causative agent of C.R.D. in fowls, but develop a disease called infectious sinusitis. This disease is characterised by bulging of the face due to exudate in the air-sinuses of the head. Infective exudate from turkeys will in turn produce C.R.D. in fowls.

It is known that pigeons also can contract disease from contact with C.R.D.-infected chickens, and that the disease can be carried back to susceptible chickens by artificial inoculation of their respiratory tract with pigeon exudate. Both turkeys and pigeons must therefore be kept in mind as sources of infection.

HOW C.R.D. AFFECTS A FLOCK.

C.R.D. is slow in spreading through a flock and generally takes three weeks to reach a peak. In growing chickens, 90–100 per cent. may become affected, but in some mild outbreaks the percentage is much less.

Once affected, individual birds continue to exhibit symptoms for a considerable time—usually about two months. Thus the disease becomes chronic.

Signs observed are coughing, throat rattle, nasal discharge, swollen or watery eyes, head shaking, decreased appetite and loss of weight. Coughing, however, may not be pronounced and in warm dry weather may be almost absent.

A constant feature of C.R.D. is the high proportion of birds with wet nostrils which tend to be covered by adhering dust particles. On pressing the nostrils of an affected bird, a cloudy, viscid material is expressed (see Plate 1).

Plate 1.

Viscid Material Expressed from the Nostril of a Bird Affected with C.R.D.

Up to 5 per cent. of cases have swollen watery eyes, although this is a feature of other respiratory infections.

Loss of weight is a common feature in growing chickens but not so much in adult fowls (see Plate 2). The proportion of "scrubbers" in young cockerels is high.

Similarly, depressed egg production is more serious in fowls early in lay.

Symptoms of C.R.D. tend to be mild in fowls over 12 months of age.

STRESS FACTORS.

There is a close relationship between C.R.D. and stress factors—that is, conditions which put some strain on the birds. This probably explains, at least in part, why the effects of the disease are greater in growing chickens and fowls in the early laying stage.

The symptoms of C.R.D. tend to be increased by cold, damp weather conditions. The disease has been observed to be more severe in groups of chickens running on damp ground than in chickens from the same hatch kept on wire.

Chickens vaccinated with fowl pox vaccine just before the onset of C.R.D. have been noted to be more upset by the disease and to remain affected two to three weeks longer than similar unvaccinated chickens on the same properties.

Stresses caused by nutritional deficiencies, poor ventilation in the fowl-house, roundworm infestation and other diseases all increase the ill effects of C.R.D.

C.R.D. itself lowers the general resistance of affected fowls. A heavy infestation of roundworms often trails an epidemic of C.R.D. in a poultry flock.

DIAGNOSIS.

There is still uncertainty as to just what constitutes C.R.D. The main difficulty is to separate it as a single disease from the complex of respiratory diseases seen in poultry. No doubt coryza and C.R.D. are often confused.

The following pointers are useful in forming an opinion as to whether or not the disease is present:—

(1) Slow spread in a flock. It takes about three weeks to affect all or nearly all individual birds. Coryza and I.L.T. have a rapid spread.

(2) Persistence of symptoms in an affected flock for about two months. Other respiratory infections may not last longer than two weeks.

(3) Coughing not as marked a feature as in I.L.T.

(4) High proportion of birds with nasal discharge. On opening the air-sinuses of the head, excessive cloudy viscid material or pus is present. Little or no nasal involvement occurs in I.L.T.

Plate 2.

Emaciated Carcase of a Cockerel 12 Weeks Old Affected with C.R.D.

(5) Air-sac infection, if present, is a useful diagnostic sign. It is characterised by cheesy material in the air-sacs behind the lungs.

(6) Excessive viscid material in the upper part of the wind-pipe. Cheesy plugs and blood-stained mucus, as seen in other respiratory diseases, do not occur in pure C.R.D.

(7) Few or no deaths. The main loss is in body weight or egg production. In a respiratory disease such as I.L.T., mortality may be high.

(8) Presence of the P.P.L.O. in exudate shown by laboratory tests. This organism may not be demonstrated early in an epidemic but be found in a second batch of live specimens a few weeks later.

Overseas, a serological test on blood samples has been developed recently as a flock test. This test is not yet used in Australia.

Control.

In order to control any respiratory disease in poultry, a diagnosis is essential, as the methods of control vary for the different respiratory diseases. The following table shows the relationship of C.R.D. to other respiratory diseases in Australia and the usual control measures used:

TREATMENT OF C.R.D.

Although it is very difficult to diagnose C.R.D. with certainty, treatment is generally well worth while if there are good grounds for suspecting the disease to be present in a flock in anything other than a mild condition.

The following antibiotics may be used:—

(1) Streptomycin, by injection into the breast muscle (Plate 3).

(2) Oxytetracycline ("Terramycin") in the drinking water (or drinking water and mash) or by injection in oily vehicle into breast muscle or under skin at top of neck.

(3) Chlortetracycline ("Aureomycin"), as for oxytetracycline.

Time to Inject.

If treatment is given at the first signs of the disease, few birds may benefit. For this reason it is recommended to wait about two weeks, by which time most of the birds are affected.

Respiratory Disease.	Cause.	Control.
Chronic respiratory disease (C.R.D.)	P.P.L.O. ? ..	Treatment with selected antibiotics
Infectious laryngo-tracheitis (I.L.T.)	Virus	Preventive vaccination
Fowl pox respiratory form ..	Virus	Preventive vaccination with either fowl pox vaccine or pigeon pox vaccine
Coryza	Coryza bacillus (*Haemophilus gallinarum*)	Usually no treatment required as the symptoms are mild. Sulphonamide drugs may be used in drinking water for non-laying birds
Fowl cholera respiratory form	*Pasturella aviseptica*	As for coryza. Serious outbreaks require selected antibiotics
Fungoid infections of throat ..	Fungus ..	Copper sulphate 1 in 2,000 in drinking water. Avoid damp conditions and other respiratory diseases
Vitamin A deficiency (avitaminosis A)	Nutritional ..	Supply an adequate vitamin A supplement in the ration

With fowls treated at the second or third week of an outbreak, some relapses are likely—that is, a proportion of treated birds may contract the disease again later on.

If treatment is delayed until say the sixth week, treated birds usually recover without any relapse, but of course much harm has been done in the meantime.

The reason for the relapses if treatment is given early in an outbreak may be that insufficient resistance has developed. Be that as it may, the advantages of treatment at 2-3 weeks remain, as the relapses are milder and shorter lasting than the disease in untreated birds.

Value of Injections.

Following injection with streptomycin, oxytetracycline or chlortetracycline, rapid improvement occurs in a C.R.D. affected flock. Symptoms largely disappear in two days, increase in appetite is evident and the birds look brighter. Chickens then put on weight and in the case of laying fowls egg production commences to rise rapidly, starting about four days after injection.

Before treatment is undertaken, however, it is highly desirable to obtain professional advice (either from a veterinarian with a poultry practice or from the Department) both as to the presence of the disease and as to the dosage and administration of the appropriate drug.

Plate 3.

Injecting Streptomycin Solution into the Breast Muscle.

Choice of treatment will depend on (*a*) cost and availability of the antibiotics mentioned; and (*b*) whether one wants the much better results obtainable by injecting the antibiotics or prefers to go to less trouble and administer them in the drinking water.

Remember that in any event the cost is covered by the first one or two eggs per bird gained from the treatment.

Streptomycin Coma.

In a small percentage of cases, birds treated with streptomycin go into a coma following injection. The coma develops within a few minutes and recovery follows 10-15 minutes later. There appears to be some connection between poor condition and the occurrence of coma.

If coma cases occur, they should be placed in an upright position away from other fowls until recovery occurs.

GENERAL MEASURES.

In a C.R.D. outbreak, ensure a liberal supply of vitamin A.

Ensure proper ventilation in the fowl-house. An air inlet at both the top and bottom of the fowl-house is suggested (see Plate 4).

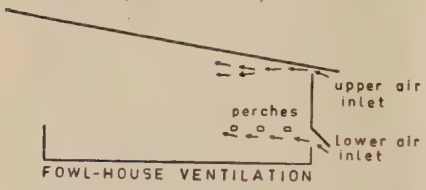


Plate 4.

Method of Ventilating Fowl-house to Reduce Danger from C.R.D.

Do not use fowl pox vaccine at the time C.R.D. generally occurs. Use pigeon pox vaccine instead.

Where both C.R.D. and I.L.T. occur on a property, preventive vaccination against I.L.T. will considerably reduce the respiratory disease problem by preventing a combined effect between these two diseases.

If necessary, deworm with piperazine.

Dry conditions help; avoid damp litter.

ERADICATION.

Eradication of C.R.D. from a flock is now a possibility. The principle involved is to collect hatching eggs for replacement purposes from hens soon after injecting them with a suitable antibiotic. The chickens from these eggs are then reared in isolation. Experience of the method is, however, as yet insufficient to enable us to say how reliable it is.

PASTURE STUDIES IN THE NORTH-WEST.

The Agriculture Department has stepped up its investigations into pasture improvement in north-western Queensland.

The Minister for Agriculture and Stock (Hon. O. O. Madsen, M.L.A.) recently announced that a pasture specialist has been appointed to Cloncurry to make a complete study of pasture improvement in the area. The officer is Mr. D. I. Sillar, a graduate in agricultural science from the Sydney University.

His main work will be to examine the methods of establishing buffel grass and to study the rate at which it spreads on the various soil types in the north-west. Soils in north-western Queensland vary considerably in phosphate content. It is believed that soil phosphate levels may have an important bearing on the ease of establishment and rate of spread of improved pastures. Mr. Sillar will also test a wide range of pasture species to determine whether there are more suitable types for the district.

The appointment of a pasture specialist to this area will also permit the scope of the investigations at the Toorak Field Station, Julia Creek, to be enlarged. Here it is planned to commence investigations into crop production, pasture improvement and pasture management.

Mr. Madsen said the major problem facing stock breeders in north-western Queensland is that natural forage declines rapidly in quality soon after the end of the wet season. Any measure that will extend the grazing season or increase the nutritive value of the forage will be an important step forward.

Count Your Chickens!

By H. I. TOFT, Division of Marketing.

What is the remedy for the present unsatisfactory economic position of the egg industry?

Can production be spread more evenly throughout the year? Can local consumption be boosted?

If home consumption can be increased to the present level of production, holding production at that level may then be the solution.

The economic position of the commercial poultry industry is causing considerable concern. The prevailing production pattern is one which directly causes marketing problems. In the 1956-57 season some 2-million dozen eggs were exported at a price which certainly did not cover the cost of producing them. It is proposed to set out here some of the major economic problems affecting the industry.

THE SUPPLY PATTERN.

The supply of eggs to The South Queensland Egg Marketing Board has followed a well defined seasonal pattern. Egg supply to the Board reaches a peak in spring and is at its lowest point in autumn. Table 1 indicates how the supply of eggs varies according to the season.

It can be seen that supplies to the Board are considerably higher for the period July to December than for the period January to June. For example, in 1955-56 about 4,200,000 dozen eggs were received by the Board between July and December while about 3,100,000 dozen were received from January to June.

TABLE 1.

RECEIVALS OF EGGS BY THE SOUTH QUEENSLAND EGG MARKETING BOARD.

Period.	1954–55.	1955–56.	1956–57.
	Dozen.	Dozen.	Dozen.
July to September	2,396,350	2,131,346	2,261,926
October to December	2,395,741	2,078,410	2,334,388
January to March	1,791,119	1,665,251	2,022,907
April to June	1,211,705	1,471,393	1,506,919
Total	7,794,915	7,346,400	8,126,140

THE PATTERN OF LOCAL SALES.

The local sales of eggs are shown in Table 2.

TABLE 2.

LOCAL SALES OF EGGS IN SHELL BY THE SOUTH QUEENSLAND EGG MARKETING BOARD.

—	1954–55.	1955–56.	1956–57.
	Dozen.	Dozen.	Dozen.
July to September	951,299	796,298	850,450
October to December	833,867	797,445	781,542
January to March	1,076,097	982,975	914,032
April to June	1,229,126	1,448,187	1,273,728
Total	4,090,389	4,024,905	3,819,752

The consumption within Queensland of eggs in shell sold through the Egg Board reaches its highest level in autumn. The local spring consumption of eggs sold through the Board is comparatively low. This is largely due to increased competition at this time of the year from backyard production. Referring to 1955-56 again, of the 4,200,000 dozen eggs received by The South Queensland Egg Marketing Board from July to December, only 1,600,000 were consumed in Queensland as eggs in shell. The excess of receivals by the Egg Board in the spring, over the local demand for eggs at that time, means that considerable quantities have to be exported.

UNSATISFACTORY EXPORT POSITION.

In the spring of 1956 approximately 750,000 dozen eggs in shell were exported by The South Queensland Egg Marketing Board to the United Kingdom. The net return to the grower for these eggs was 1s. 6d. per dozen. An average cost of production of eggs in Australia has been recently estimated at approximately 3s. 0d. a dozen.* This does not include labour. The net return to growers in south Queensland of approximately 1s. 6d. a dozen for eggs exported to the United Kingdom does not compare very favourably with 3s. 0d. a dozen cost of production. The net return to growers for eggs exported to the United Kingdom as pulp during the period July, 1956, to June, 1957, was also low at approximately 2s. 3d. a dozen.

It does not seem likely that the market for exported eggs will improve to any marked extent, at least in the near future. Britain, our principal market for eggs, produced about 60 per cent. of her own egg requirements before the war. She now produces about 95 per cent. As things are, her production is not likely to fall below this level. About £35,000,000 subsidy was paid to the United Kingdom poultry industry in 1956-57. At present it is proposed to subsidise the industry until 1962. Attempts to divert exports to other overseas markets have not been very successful, due to differences in general price levels.

The prospect of exporting eggs at a price which covers the cost of producing them doesn't seem good. The question then arises, "To what extent does this affect the industry?" The annual supply of eggs to The South Queensland Egg Marketing Board over

* This was the estimated cost of production in "A Plan for Stabilisation" recently submitted to the Minister for Primary Industry by Mr. Clive H. Rice, B.Com., supported by a committee representative of the Victorian poultry industry.

the last few years has varied from about 7 to 8 million dozen. As things are it looks as if some 2 million dozen eggs are to be produced and sold overseas at less than it cost to produce them.

PROBLEMS OF IMPROVEMENT.

It has been mentioned that the pattern of supply to The South Queensland Egg Marketing Board has been one of high spring and low autumn deliveries. The total annual supply to the Board has been about 2,000,000 dozen eggs higher than the home purchases of these eggs. The export position has been unsatisfactory lately, largely as a result of subsidised United Kingdom production, and differences between our price level and lower price levels in possible markets.

That is the situation. How would the export position be improved if changes in the position could be brought about?

The pattern of supply and demand is one aspect. The concentration of production in spring is a considerable factor in increasing the proportion of production which has to be exported. Apparently this problem can be remedied to a large extent by management. It is believed that considerable changes can be brought about in the laying habits of a flock, so that spring production is reduced and autumn production increased.

Such a change in the seasonal pattern of supply can probably do a lot to lessen the need to export. At present it is necessary to export a large number of eggs because they are perishable and because during spring months home consumption of commercial eggs does not keep up with commercial production.

There are other sides to the problem. Even if the seasonal pattern of our 7–8 million dozen eggs annual commercial production was levelled out as far as possible, there is still the fact that home consumption of these eggs is only 5–5½ million dozen annually. This leaves about 2 million dozen eggs to be exported at low prices. It would probably not be practicable to reduce total commercial production, so suppose efforts were directed towards increasing home consumption of commercial eggs.

Various methods may be employed in an attempt to achieve this. Among them are advertising, improved packaging of eggs, and if sales responded well enough, price reduction on the home market. Recently, competition from backyarders has been reduced by exempting only flocks of less than 50 fowls from compulsory registration with the Egg Board.

It seems quite on the cards that a greater number of commercially produced eggs can be sold on the home market. Consumption of eggs in some other countries shows that dietary habits can include the consumption of far more eggs per person than are eaten in Australia. The following estimates of *per capita* consumption of eggs are relevant:—

United Kingdom ..	211
Canada	288
Irish Republic ..	270
U.S.A.	342
Australia	194

An Australian pre-war average has been estimated at 235 eggs. Perhaps it would be possible to sell as many eggs as are now produced commercially —that is, about 8 million dozen—on the home market.

Probably the industry would not remain at a level where all its production was being sold on the home market at reasonable prices. The

returns to growers would probably result in an increase in production. This would lead to exports and lowered returns per dozen. However, the situation probably would not return to that prevailing at present. The incentive for growers to enter the industry would be small well before returns reached their present level.

The increase in home consumption of commercially produced eggs could be a more complete answer to export and low return problems if it could be coupled with controlled production in some form. The idea is that endeavours could be made to increase home consumption of commercially produced eggs at least up to the present level of commercial production, and then to hold production at that level. Without this control, as already mentioned, production would probably increase, leading to exports at prices which at present do not cover the cost of production.

SUMMING UP.

It seems desirable that a portion of normal spring production be switched to autumn.

An increase in home consumption of commercial eggs should lead to returns to growers somewhat better than at present available. However, with uncontrolled production it would seem difficult to achieve very high returns to growers per dozen eggs on any permanent basis. For the same reason, when home prices for commercial production are high enough to give a reasonable return on home market sales, uncontrolled production is almost certain to be at a level which necessitates exporting of eggs.

KEEPING THE NEW-LAID QUALITY OF EGGS.

Hens are the only livestock that give us their product already pre-packed in a reasonably strong and clean container. This has led many people to forget the the egg is a perishable food and quickly goes stale, if not bad, unless treated properly.

High temperature and low humidity are the biggest enemies of egg quality, says Mr. B. W. Moffatt, Poultry Adviser, Department of Agriculture and Stock. Heat will cause the contents of the egg to break down, while storage in dry air will cause it to lose moisture and become stale.

The coming of summer is a reminder to poultry farmers to pay attention to the storage of eggs on the farm. Your part in preserving the new-laid quality in eggs starts as soon as they are laid. Gather the eggs frequently—always twice a day and in very hot weather three times a day. This prevents the eggs being re-heated when other hens visit the nest. Use wire baskets for gathering the eggs, as they hasten cooling.

While they are awaiting despatch to market, store your eggs in a cool room, well ventilated and free from odours. Keep the humidity high. If you haven't a charcoal cooler, dampened bags or hessian draped near the cases in a cool spot will help. By providing clean nests and so producing clean eggs, washing of eggs can be avoided. Washing destroys the bloom on the shell and allows bacteria to enter; this can result in rotten eggs.

This summer, the Department is examining the value of charcoal coolers for retaining egg quality on the farm. These coolers, which are similar to the types used for holding dairy produce, could prove a useful aid to poultry farmers in helping them to market only top-quality eggs.

A Survey of Dairy Herd Wastage in Queensland

By C. H. CLARK, Adviser (Herd Recording).

Low production and old age are the chief reasons for cows being taken out of dairy herds in Queensland.

Diseases such as mastitis, sterility and abortion also lead to the disposal of many cows.

Information concerning dairy herd wastage in Queensland was collected from members of herd recording groups during the period 1948-1955. The material has now been collated, and is presented here to draw attention to the main causes of losses of cows from dairy herds.

The information used in compiling the survey was furnished by farmers in various parts of the State, who co-operated by supplying particulars of their herds and herd wastage to Herd Recorders. The survey was made over a period of seven years from July, 1948, to June, 1955.

The number of herds included and their distribution are given in Table 1. The number of herds surveyed in each year depended largely on the number that were recorded continuously from July of one year to June of the succeeding year. During some years (particularly the drought year 1951-52) many herds were withdrawn from recording for short periods. The incomplete information available for these herds was discarded.

TABLE 1.

Distribution of Herds.

District.	Year.							
	1948 –49.	1949 –50.	1950 –51.	1951 –52.	1952 –53.	1953 –54.	1954 –55.	Totals.
North Queensland ..	7	11	11	5	9	42	36	121
Central Queensland ..	11	..	..	..	2	20	52	85
Upper and Central Burnett	9	..	..	3	..	7	19	38
South Burnett	9	34	23	8	35	57	81	247
South-eastern Queensland	22	18	33	60	49	120	221	523
Darling Downs	6	3	6	6	6	15	41	83
Totals	64	66	73	82	101	261	450	1,097

SEASONAL CONDITIONS.

Rainfall figures for districts included in the survey were supplied by the Brisbane Meteorological Bureau and are shown in Table 2. They indicate that (apart from the year 1951-52) rainfall was mostly above normal in all areas covered by the survey.

TABLE 2.

Approximate Average Rainfall for the Years 1948–1955.

Year.	District.				
	North Coast (Barron).	South Coast (Port Curtis).	South Coast (Moreton).	Darling Downs (East).	Darling Downs (West).
	in.	in.	in.	in.	in.
1948	53	31	45	27	21
1949	76	43	51	31	20
1950	93	55	70	41	34
1951	38	24	37	26	15
1952	53	40	39	30	23
1953	79	41	48	43	24
1954	58	57	62	35	35
1955	79	53	59	31	28
Average Annual Rainfall	66	37	46	26	21

Composition of Herds.

The average herd included in the survey was composed of 49 cows, 2 bulls, 17 heifers (weaning to calving) and 13 calves (1 month to weaning). Table 3 shows that the percentages are —cows 61 per cent., bulls 2 per cent., heifers 21 per cent. and calves 16 per cent.

It appears that the number of replacement animals (heifers and calves) kept on farms is fairly constant each year irrespective of the nature of the season.

TABLE 3.

Composition of Herds (Percentages).

	Year.							
	1948 –49.	1949 –50.	1950 –51.	1951 –52.	1952 –53.	1953 –54.	1954 –55.	Av. 1948 –1955.
Cows (Milking and Dry) ..	60·6	62·9	60·1	59·2	60·0	60·8	60·8	60·7
Bulls	2·5	2·5	2·2	2·2	2·0	2·2	2·2	2·2
Heifers (Weaning to Calving)	20·0	20·7	21·0	20·9	22·0	19·7	21·7	21·0
Calves (1 month to Weaning)	16·8	13·9	16·7	17·7	15·9	17·3	15·3	16·1

TABLE 4.

Wastage of Cows.

	Year.							
	1948–49.	1949–50.	1950–51.	1951–52.	1952–53.	1953–54.	1954–55.	Av. 1948–1955.
Percentage wastage including cows sold for dairy purposes	27·5	18·7	20·1	23·7	16·7	17·2	19·6	19·5
Percentage wastage excluding cows sold for dairy purposes	19·3	15·8	16·8	21·8	14·7	15·1	17·3	16·8

Wastage of Cows.

The chief reasons for disposals of cows in Queensland in order of importance are:—

(1) Low production.

(2) Old age.

(3) Sales of surplus stock for dairy purposes.

(4) Udder troubles.

(5) Sterility and abortion.

These reasons for disposal follow the same pattern as that revealed by New South Wales and New Zealand investigations.

The total wastage of cows included in this survey is set out in Table 4. Cows sold for dairy purposes are not lost to the industry and therefore cannot be included in determining true wastage. They represented a maximum of 8.2 per cent. of disposals in 1948-49 and a minimum of 1.9 per cent. in 1951-52. Excluding such cows, the average wastage of cows for the 7-year period was 16.8 per cent. This means that on the average the milking herd is completely replaced every six years.

In collecting information for this survey, in many cases the age of the animal was not known. Therefore, it

TABLE 5.

Causes of Wastage Shown as Percentages of all Cows.

Cause.	Year.							
	1948–49.	1949–50.	1950–51.	1951–52.	1952–53.	1953–54.	1954–55.	Av. 1948–1955.
Low Production	5·4	6·3	8·1	7·6	6·6	6·6	8·5	7·5
Old Age	5·1	3·7	2·3	3·4	2·8	2·3	2·6	2·8
Udder Troubles	2·9	1·2	1·1	0·8	1·0	0·7	1·0	1·0
Sterility and Abortion ..	1·3	0·8	1·2	1·5	0·8	1·1	0·9	1·0
Calving Troubles	0·7	0·6	0·6	0·7	0·3	0·4	0·4	0·5
Tuberculosis	0·5	0·1	0·03	0·6	0·5	0·2	0·2	0·2
Accident and Injury ..	1·0	0·8	1·2	1·2	0·4	0·6	0·9	0·8
Other Known and Unknown Causes	2·4	2·3	2·4	6·0	2·3	3·2	2·7	3·0
Total Wastage ..	19·3	15·8	16·9	21·8	14·7	15·1	17·2	16·8

is impossible to assess the average age of disposal or to analyse wastage according to age. From Table 5 it appears that 6.5 per cent. of total wastage is directly due to disease, accident, injury, and drought; and the disposal of many young animals must have resulted from these causes. Serious economic losses must result if cows have to be culled before reaching full production.

than any other diseases. In some districts in which most farms are supplying milk to cheese factories and/or the wholemilk market, the incidence of mastitis has decreased since 1948-49. It appears that the frequent laboratory testing of samples of milk from herds in these areas has led to the early detection of the disease and the more extensive use of antibiotics in its treatment.

TABLE 6.

Causes of Wastage of Cows Shown as Percentages of Total Cow Wastage Excluding Cows Sold for Dairy Purposes.

Cause.	Year.							
	1948 –49.	1949 –50.	1950 –51.	1951 –52.	1952 –53.	1953 –54.	1954 –55.	Av. 1948 –1955.
Low Production	28·2	39·9	48·3	34·9	45·2	43·8	38·9	44·4
Old Age	26·3	23·6	13·4	15·3	18·9	15·1	14·1	16·5
Udder Troubles	14·9	7·5	6·5	3·6	7·0	4·5	8·4	6·1
Sterility and Abortion ..	7·0	5·0	6·9	6·8	4·9	7·3	14·1	6·1
Calving Troubles	3·5	3·8	3·3	3·2	2·1	2·9	5·0	2·8
Tuberculosis	2·5	0·8	0·2	2·5	3·7	1·0	0·4	1·5
Accident and Injury ..	5·4	4·8	7·0	5·3	2·9	4·0	5·7	4·9
Other Known and Unknown Causes	12·2	14·5	14·5	28·4	15·4	21·4	13·4	17·8

Tables 5 and 6 show the various causes of wastage. Table 5 expresses the figures as percentages of all cows, while Table 6, which shows each cause as a percentage of total wastage, gives a clearer picture of the importance of each cause. It will be seen that low production and old age constitute the chief reasons for culling. As the herds included in the survey have been recorded for production for various periods, it is probable that herd recording is responsible for a heavier culling rate for low production than would be the case in the majority of non-recording herds.

Udder troubles (chiefly mastitis), sterility and abortion cause more wastage in dairy cows in Queensland

The incidence of sterility and abortion seems to have been fairly constant during the period of this survey.

Attention is drawn to the appreciable wastage caused by accidents and injury in all districts for each year of the survey. "Other known and unknown causes" accounts for 3.0 per cent. of wastage (Table 5). Losses from poisoning, bloat, tick fever, milk fever, drought and other causes are included under this heading.

Wastage of Bulls.

An attempt was made in this survey to determine the wastage of bulls in herds, so that an estimate could be

TABLE 7.

Wastage of Bulls.

Year.	1948 –49.	1949 –50.	1950 –51.	1951 –52.	1952 –53.	1953 –54.	1954 –55.	Av. 1948 –1955.
Percentage Wastage ..	33·6	19·5	6·8	29·5	13·7	21·6	23·2	21·9

made of the average number of bulls required for replacements each year. The results are shown in Table 7, the range being from 6.8 to 33.6 per cent. The average wastage for the seven years is 21.9 per cent., which indicates that the 21,000 dairymen in Queensland require approximately 4,600 bulls each year.

It is interesting to note that the total number of breeders of purebred dairy cattle registered with the five herd book societies in this State is 1,257, but only 11 per cent. of them are recording their herds under the Purebred Production Recording Scheme. It would appear that although sufficient purebred bulls are available each year to satisfy the demands, many commercial dairymen would be unable to purchase bulls from herds recorded for production.

Replacement Heifers.

In Table 2 it was shown that heifers (weaning to calving) constitute about 21 per cent. of the average herd. The average amount of wastage of heifers from the time of weaning until they calve is shown at 9.6 per cent. in Table 8. This information was prepared to obtain an estimate of the number of heifers which are actually used as replacements. It indicates that sufficient heifers are available for replacement purposes, after allowing for wastage, to maintain the strength of the milking herd.

TABLE 8.

Wastage of Replacement Heifers.

Year.	1948 –49.	1949 –50.	1950 –51.	1951 –52.	1952 –53.	1953 –54.	1954 –55.	Av. 1948 –1955.
Percentage Wastage ..	9·1	4·3	5·2	6·7	8·2	12·0	10·8	9·6

Calf Wastage.

Table 9 gives the percentages of male and female calves born and the percentages reared. Perusal of the table shows that approximately 60 per cent. of all heifer calves born each

TABLE 9.

Sex of Calves and Percentages of Calves Reared.

	Year.							
	1948 –49.	1949 –50.	1950 –51.	1951 –52.	1952 –53.	1953 –54.	1954 –55.	Av. 1948 –1955.
Heifers Born	47·0	44·1	45·5	45·4	46·4	44·1	45·3	45·2
Bulls Born	53·0	55·9	54·5	54·6	53·6	55·9	54·7	54·8
Heifers Reared	68·9	58·7	61·3	67·5	62·8	60·6	62·8	62·7
Bulls Reared	13·5	7·7	12·4	10·9	7·9	8·4	8·9	9·3

year are reared. This would indicate that sufficient heifer calves are being reared for herd replacements.

Table 10 gives particulars of the disposal of surplus calves, and also shows the percentage of calves which were still-born or died before they were one month old. Two out of three calves died or were disposed of soon after birth. The chief method of disposal was by slaughter.

Discussion.

This survey indicates the general order of importance of the chief dairy cattle losses. The extent and the nature of some causes of wastage in individual herds are concealed when the records are expressed as an average for the State as a whole. The average figures put less emphasis on the extreme cases. For example, they do not highlight herds in which, say, mastitis may account for heavy wastage, nor, on the other hand, herds which are almost completely free of disease and show only a small amount of wastage. This survey presents a picture of average conditions.

The general position indicates that low production and old age are still the chief reasons for wastage in dairy herds. Disease—particularly mastitis, sterility and abortion—is responsible for appreciable wastage, and every effort must be made to diagnose and treat or apply preventive measures to decrease the incidence as much as possible.

TABLE 10.

Disposal of Calves not Reared Shown as Percentages of all Calves Born.

	Year.							
	1948–49.	1949–50.	1950–51.	1951–52.	1952–53.	1953–54.	1954–55.	Av. 1948–1955.
Stillborn	0·7	0·4	0·4	0·5	1·0	0·4	0·5	0·5
Died or Killed by Dingoes	2·4	2·2	2·1	1·5	1·7	1·6	1·7	1·8
Sold	27·5	42·8	26·6	23·0	33·1	28·9	28·3	29·2
Slaughtered	29·8	24·3	36·3	38·4	30·9	37·6	36·2	35·2
Total Disposal ..	60·4	69·7	65·4	63·4	66·7	68·5	66·7	66·6

PARALYSIS IN BEES.

Several cases of paralysis, a persistent form of dwindling in adult bees, have been recorded in southern Queensland apiaries during the last few weeks.

Mr. C. Roff, Adviser in Apiculture, Department of Agriculture and Stock, says occasional outbreaks of the disease can be expected during the spring and summer months. Steps to be taken against paralysis are based on the apparent difference in resistance of bee strains and involve re-queening affected colonies with young, vigorous queens from unaffected and unrelated stock. The trouble usually disappears from the re-queened colonies when the old bees have been completely replaced by the progeny of the new queen.

Mr. Roff regards it as unwise to defer re-queening simply because an average crop of honey may, for a while, be given by mildly diseased colonies. The strain should be changed immediately paralysis appears.

Production Recording of Goats

By S. E. PEGG, Chief Adviser, Herd Recording.

Goats have been kept in Queensland for many years. Indeed, without them many of the western townships would have been without a supply of fresh milk.

Most of these herds are of mixed breeds, but there has recently been a big increase in the keeping of goats of various pure breeds. The main breed of milking goat in Australia is the Saanen. Toggenbergs and other breeds have also been introduced recently.

In most of the States, goats' milk is in demand because of the belief that it is of value in the treatment of certain stomach disorders. Numerous cases have been reported of young children who, being unable to digest cows' milk, have thrived when given goats' milk. To meet this demand several studs have been established throughout the State. The Secretary of the Queensland Branch of the Australian Goat Breeders' Society advises that the membership of the Society is now 150.

Many of these breeders realise the importance of the selection of breeding stock according to production, so as to increase the milk yield of the herds. With this in view, the Queensland Branch of the Goat Breeders' Society approached the Department of Agriculture and Stock with a request for a production recording scheme. After careful consideration it was decided to accede to the request.

Herds are now being accepted for recording provided a recording officer can do the work without its interfering with his work of recording cow herds. They are recorded under the rules governing the Production Recording of Pure Bred Dairy Cattle. All goats in the herd must be sub-

TABLE 1.

Average Production of Goats in Each Age Group.

Age.	No. of Goats.	Average Production.		
		Milk (lb.)	Test (per cent.)	Milk Fat (lb.)
Mature	6	985	3·6	35
Senior 4	1	978	3·7	36
Junior 4	2	1,295	4·1	53
Senior 3	1	1,211	3·5	42
Junior 3	1	1,125	4·3	48
Senior 2	2	2,380	4·1	97
Junior 2	9	1,456	4·3	63
Senior Yearling	5	929	4·0	37
Junior Yearling	8	889	4·0	36
Total	35	1,184	4·05	48

mitted as they come into production. Recording was commenced in November, 1955.

During the 1956-57 recording year seven herds were recorded. Thirty-five goats from these herds completed a lactation period of 300 days or less and their average production was 1,184 lb. milk and 48 lb. milk fat. The average milk fat test was 4.05 per cent.

The number recorded in each age group and their average production are given in Table 1.

The highest production for a 300 days period was 2,820 lb. milk and 121 lb. milk fat, the average test being 4.3 per cent. Four goats yielded more than 2,000 lb. milk in a similar period.

The average length of lactation of the 35 goats was 246 days. The numbers which milked for various periods are:—

Length of Lactation (days).	No. of Goats.
300	12
270	6
240	6
210	5
180	1
150	4
120	1

From the figures quoted it is evident that goats can yield a considerable amount of milk. This amount can be increased by a careful breeding programme based on the selection of animals with a proved production ancestry.

IT PAYS TO HAND POLLINATE PAPAWS.

Papaw yields can be increased if natural pollination is supplemented by hand pollination in the plantation. Mr. J. B. Davey, Experimentalist, Department of Agriculture and Stock, says the higher production is the result of both an improvement in fruit setting and an increase in individual fruit size.

When a papaw flower is adequately pollinated, the fruit developing from it will be fully seeded and the flesh will be uniformly thick. However, where fertilisation is incomplete, the fruit is only partially seeded and flesh thickness is variable, being greatest where seed development is at a maximum and least where seeds are few or absent. This thickening of the flesh where seeds are plentiful occurs because the seeds stimulate growth processes in the tissues of the fruit.

Commercially, hand pollination has its most important application in young plantations, especially for the first crop, when flowers can be reached easily from the ground. It is particularly valuable in the early flowering period—which usually occurs during late October to early November, when pollen production is often below normal—and again during February, March and April, when wet weather conditions tend to interfere with natural pollination.

Hand pollination in itself is a simple procedure. It involves the use of mature male flowers just before they open their petals, as it is at this stage that the pollen is shed. The petals are removed and the flower tested for free pollen by dusting lightly on the hand. The flower is then used as a brush to transfer pollen to the surface of the five protruding stigma lobes of the female flowers. Only recently opened female flowers should be pollinated; the non-receptive stage is indicated by the development of a brown colouration in the stigmas.

Either a number of mature male flower buds collected just prior to pollinating can be carried to provide the necessary pollen, or, if male trees are plentiful, a whole branch of flowers can be taken from the male tree and from it suitable buds can be selected as required. One male flower should pollinate two to three female flowers. For best results, hand pollinating throughout the plantation should be done twice a week during the flowering period.

Pleuropneumonia of Cattle

By D. V. MAHONEY, Divisional Veterinary Officer, Townsville.

Pleuropneumonia is an introduced disease which causes serious cattle losses in Queensland.

It is transmitted by direct contact only and a reliable preventive vaccine is available. Control is only difficult where cattle are run over large areas.

The use of existing control methods will eradicate the disease in closely settled areas, but final cleaning up of the present areas of regular infection can only follow development of more intensive methods of cattle management.

Even where total eradication is not yet practicable, control measures greatly limit the economic loss.

Contagious bovine pleuropneumonia (C.P.P. or "pleuro"), is the most serious contagious disease which affects cattle in Queensland.

After its introduction to Victoria by an infected cow which arrived from England in 1858, pleuro spread rapidly over the Australian mainland. It appeared in Queensland in 1862 and by 1880 it had reached Darwin. Enormous losses accompanied the initial invasion. By 1864 it had killed over 100,000 head in Queensland, and in the first 15 years of its existence in Australia it caused the loss of 1½ million animals.

At present, pleuro is confined to the Kimberleys, the northern half of the Northern Territory, and northern and south-western Queensland.

Eradication from the rest of Australia was almost completed during the 1930's before an accurate blood test for the detection of carriers was in general use and before a standardised vaccine was produced. This was possible because pleuro control primarily depends on being able to control the movements of all infected and in-contact stock, and the cattle industry in the southern States and in south-eastern Queensland was sufficiently developed to permit that.

Pleuro thrives only under "big herd" or primitive conditions. The history of the disease since it first appeared in Europe has been one of rapid spread through most of the great cattle countries of the world and then gradual decline and eradication in places where the standard of livestock management is high. It has persisted only in a few areas where the cattle are comparatively uncontrolled, such as northern Australia and parts of North Africa.

METHOD OF SPREAD.

Pleuro is caused by a minute organism or germ which is present in the lungs of every infected animal. It is present in the particles of moisture exhaled by affected animals, and transmission takes place when a healthy beast inhales these infective droplets. Because the disease can only be spread through the air, contamination of water, drinking vessels, soil or pasture is not important.

Close contact between infected and healthy stock is necessary, especially in northern Australia where a hot dry climate prevails for most of the year. This is because the germs are very susceptible to drying and most of them are killed after being in the air for only a short time.

The conditions which exist in big mobs of cattle on the road are ideal for its spread. Animals are rarely more than a few yards apart during the day and each night a thousand or so are huddled together on camp in a space less than an acre. When these cattle are not vaccinated before commencing the journey, one carrier can cause a pleuro outbreak which spreads with a severity rarely seen elsewhere than in northern Australian stock.

The time between infection and the actual appearance of the disease is variable and may be as long as four months. This feature favours its spread, because an animal may travel many hundreds of miles while the disease is developing.

SYMPTOMS.

Pleuro causes fever, leading to dullness, watering at the eyes and loss of appetite. Dairy cattle show a falling off in milk yield, and affected beasts among travelling stock fall back to the rear of the mob. Beasts left on their own seek the shade and generally linger close to water.

The head is held out, saliva drips from the mouth, there is a discharge from the nose, and the rate of breathing is increased. Movement of the flanks is pronounced and the animal grunts on breathing out. A soft, heaving cough is often seen; it is more prone to occur after any movement.

Later in the course of the disease, the animal stands with its back arched, legs apart, head down and ears drooped. The eyes become sunken and condition falls away.

Swelling of the brisket is occasionally seen.

When exercised, an infected beast shows undue respiratory distress, coughs frequently, and drools copious amounts of saliva from the mouth.

A typical case will show some or all of the symptoms described above, but a considerable number of infected cattle exhibit little or no outward signs of sickness even though large portions of their lungs may become diseased. These are known as subclinical cases, and they can spread the disease even though they may never be recognised.

POST-MORTEM APPEARANCE.

The principal changes are seen in the chest cavity. The affected side or sides may contain anything from a few ounces to a few gallons of fluid which varies in colour from amber to a brownish red. Yellow jelly-like clots float in the fluid. Portions of the lungs and chest wall are bound together by adhesions, and the free surfaces are covered by yellow clots.

The affected lung is enlarged, firm to the touch (like liver), and much heavier than normal. Its surrounding membrane is dull and thickened.

When the lung is sliced, yellow fluid oozes from the cut surface. This surface presents a marbled appearance, with a network of thick white strands interspersed with dark-red, pink and grey areas, which represent different stages of the pneumonia.

Changes which take the form of pale blotches on the surface are usually seen in the kidneys.

A beast in the recovery stage presents a different picture. Most of the fluid disappears and the affected portion of the lung becomes walled off by dense white tissue. The white network is still present inside the diseased area, but the intervening spaces are occupied by yellow, cheesy material. The part is generally adherent to the chest wall and is known as a sequestrum.

The animal, although it may appear normal, is a carrier of the disease and may become capable of infecting healthy stock if exposed to stress of climate or travelling.

THE CARRIER.

A carrier is an animal in whose lung a sequestrum has formed. A sequestrum may persist for 10-15 months before complete healing takes place.

In some cases the walling off of the affected part is not complete, and there is a discharge of pus into the air passages of the lungs. Such animals usually remain unthrifty and are inclined to have a cough. They are known as "lungers" and spread the disease during the time of their convalescence.

In other cases recovery is rapid and the sequestrum becomes completely walled off. There is no escape of infection from it and the beast shows no sign of illness. However, physical strain, such as a long journey by road, will cause the germ to escape to adjacent parts of the lung and bring about a recurrence of the severe form. This type of carrier is a dangerous spreader of pleuro because it may pass through the hands of many owners before it finally shows up. Unlike the "lunger," it spreads the disease only when it suffers a relapse.

VACCINATION.

Immunity which lasts for at least a year can be induced in susceptible cattle by introducing a small quantity of vaccine into the soft tissue at the tip of the tail. This vaccine must contain large numbers of the living pleuro-pneumonia organism.

The Vaccine.

In the early years, it was found that the amber fluid from the chest cavity of an infected animal (natural virus) was satisfactory. However, in 1936 the C.S.I.R.O. culture vaccine was produced and this is now very widely used. This product is prepared in the laboratory and each dose contains a standard number of living organisms. It is uniform in character and action and properly controlled tests have shown that it is nearly 100 per cent. effective. Many years of field experience have proved its reliability.

Vaccination is a preventive measure and not a cure. As mentioned earlier, pleuro can take as long as four months to develop after infection takes place, and vaccination during the incubation period has little effect on the course of the disease.

This is why losses often drag on for two or three months after vaccination. A proportion of the animals which were infected before-hand become obvious cases. The odd case which is often seen among vaccinated cattle on the road occurs for the same reason. Vaccination has no effect on carriers.

The vaccine does not retain its potency indefinitely. Careless handling can also bring about a premature decline in its activity. To obtain the best results the following rules should be observed:

(1) Always store the vaccine in a cool place.

(2) Do not use vaccine after the expiry date on the label of the bottle.

(3) Do not leave full bottles of vaccine in direct sunlight while waiting to be used.

(4) Do not use disinfectants to "clean" needles, syringes or any other container used for vaccine during the operation.

(5) Discard the partly used bottle of vaccine at the end of the day; do not re-stopper it for future use.

Methods of Vaccination.

The syringe and seton methods of vaccination are extensively used and the method of choice is a matter for the individual.

The seton method is reliable in the hands of a careful operator, but the syringe method is cleaner, quicker and results in more economical use of the vaccine. It also has the advantage that it can be used in conjunction with dipping operations. If cattle were vaccinated with setons immediately prior to dipping, it is probable that the dipping fluid would destroy the organisms in the vaccine and prevent the development of immunity. However, syringes are liable to develop mechanical faults which may escape notice for a considerable time.

A crush is necessary for efficient vaccination and each beast should be bang-tailed after the injection.

The most suitable type of syringe for vaccination is one which can be adjusted to deliver the correct dose of one-fifth of one cubic centimetre. Syringes of this type are now available. Needles of 18 gauge and three-quarters of an inch long are favoured.

The operator fills the syringe himself and holds it. An assistant pulls the tail out to the side of the crush, parts the hair on the end and directs the tail end to the operator. The dose is deposited in the substance of the tail about one inch from its tip.

The seton method consists of inserting a woollen thread soaked in vaccine under the skin of the tail about 1½ in. from the tip. This is done by using a lancet-shaped needle with a slit near its point. The soaked thread is placed in the slit and the needle thrust through the tail and withdrawn quickly, leaving the seton in the wound.

The seton operator requires more assistants than the syringe operator. He should have an assistant attending to the soaking of the setons and the threading of the needles and another stripping or clipping the hair from the end of the tail so that the seton can be inserted without obstruction. With a long crush a runner is necessary between threader and operator.

As the setons are usually soaked in an open container, care should be taken to keep them as free from dust as possible. The needles should be threaded with a pair of clean forceps to minimise contamination with dirt.

Effects of Vaccination.

Immunity is developed three or four days after vaccination. About the same time a swelling which extends for a few inches along the end of the tail appears; this swelling gradually subsides in a matter of a few weeks.

In a few cases a severe reaction may occur for reasons not completely understood. Extreme sensitivity of the individual animal to the virus plays a large part in these extreme reactions.

Sometimes the swelling involves all of the tail or even the rump. This type of reaction, which is more prone to occur in dairy and stud beef cattle, is called a "bad tail"' and generally appears suddenly 3-6 weeks after vaccination. It is not due to contamination of the vaccine with harmful germs or to injury of the bone in the end of the tail, but to the abnormal reaction of the beast to inoculation. The animal shows signs of illness and death may follow.

Losses can sometimes be prevented by amputating the tail at a level above the swelling where free bleeding occurs. If the rump becomes affected, the swelling should be lanced in two or three places to allow free drainage. Large doses of drugs such as penicillin and chloromycetin assist the recovery of such cases.

Of all the cattle vaccinated annually in Queensland (approximately 400,000) less than 1 per cent. develop "bad tail."

Young calves sometimes develop lameness and swelling of the joints after vaccination, but this is very uncommon in the infected areas of North Queensland.

CONTROL.

When pleuro is introduced into clean areas, control is undertaken along the following lines:—

(1) The property or properties on which cases have occurred are quarantined and a buffer area declared around the quarantine zone.

(2) All cases detected are destroyed.

(3) All cattle in the infected and buffer area are vaccinated.

(4) Quarantine restrictions are maintained until such times as the disease has been brought under control.

(5) When practicable, a blood test is applied to the herds to detect the infected animals and carriers which escape detection.

Such measures are designed to prevent the spread of the disease and if possible eradicate it. They are always carried out under the supervision of a Departmental officer.

The disease is always present in herds in practically all parts of North Queensland and the south-west channel country. In these areas control is difficult because of the "big herd" methods practised there.

Where outbreaks are detected, quarantine restrictions are imposed and vaccination is enforced. However, the application of the blood test for eradication of the disease is impracticable. Control must be based on the use of vaccination to build up resistant herds so that the existing carriers and sub-clinical cases will eventually die or recover without passing the disease on.

This can only be achieved by co-operation of stock-owners in carrying out a plan of regular vaccination of their herds. A programme of annual herd vaccination combined with the destruction of clinical cases would reduce the incidence of pleuro in a herd to negligible proportions over a period of five years.

The vaccination of a herd every now and again is not good enough, because the continual infection of young stock is sufficient to keep the disease incidence high.

Those properties which cannot operate to a regular programme should vaccinate all young stock at branding or weaning each year and carry out herd vaccination as often as possible.

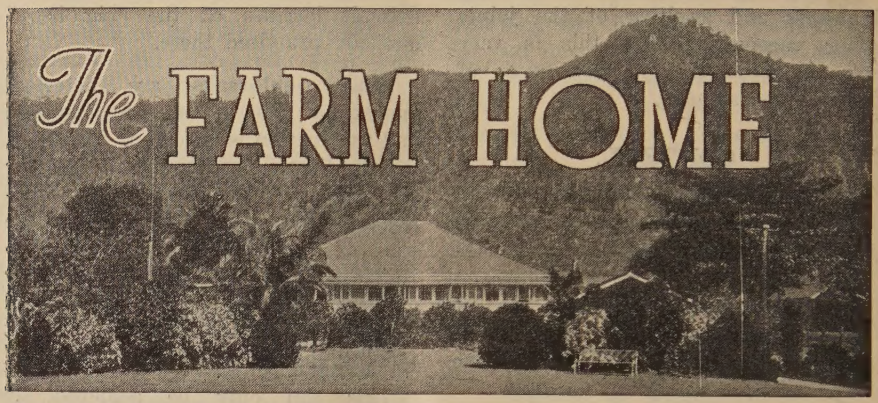
REDUCING MOULD IN ORANGES.

A simple method of controlling mould in oranges packed for market in fibreboard containers is being examined in Queensland, states the Department of Agriculture and Stock. The method consists of maintaining a trace of ammonia in the atmosphere surrounding the fruit.

It has long been known that ammonia will prevent the development of mould in citrus fruit, but as oranges are usually packed in wooden cases it is difficult to maintain the concentration of ammonia necessary to control mould growth.

However, the modern trend towards the use of fibreboard cartons for packing citrus fruit makes it possible to retain sufficient ammonia in the pack to control mould. This is done by packing with the fruit small chemical pellets that release ammonia when moistened. The pellets, moistened before packing and kept damp by the moisture given off by the fruit, release ammonia continuously and maintain the concenration necessary to check mould growth.

In the Agriculture Department's exploratory trials, mould development was reduced by more than half without injuring or tainting the fruit.



Thumb Sucking by Youngsters

Contributed by the Department of Health and Home Affairs.

Thumb sucking gives the young child comfort and satisfaction, but the habit is a source of annoyance to the parents.

As it is a source of comfort to the child, he persists with thumb sucking as long as he is left to entertain himself.

The treatment of thumb sucking is largely a matter of management. Usually, the habit does not cause any great harm, other than sometimes a sucked thumb appears thinner than an unsucked one, and the child's teeth may become protuberant. Some medical experts state that the sucked thumb and the teeth suffer no permanent damage because of thumb sucking. If this is the case, it doesn't matter if the child does suck his thumb.

Most parents, however, are loath to accept this idea. They are annoyed to think their child is a thumb sucker and so they reprimand him and this act of reprimanding finally becomes a habit with them.

On the other hand, other medical experts believe that continued thumb sucking may cause displacement of the upper teeth and nasal septum, which will lead to adult mouth breathing. If this is so, and thumb sucking is thought to be the cause, medical advice should be sought.

This does not mean that parents should begin to nag at the child. Rather, they should quietly try various remedies under medical supervision—for example, making the child wear mittens, or painting the fingers with bitter aloes or even with nail varnish.

As a child becomes older and finds more to occupy his attention in the form of school, games, hobbies, and so on, he will lose his habit of sucking his thumb.

Remember! Be careful not to nag at children who suck their thumbs. If you do, you may find one habit replaced by another, or your child may become emotionally unstable.

Any further information concerning this and other matters affecting children may be obtained by communicating personally with the Maternal and Child Welfare Information Bureau, 184 St. Paul's Terrace, Brisbane, or by addressing letters "Baby Clinic," Brisbane. These letters need not be stamped.